CHEMICAL & METALLURGICAL ENGINEERING

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June 16, 1924

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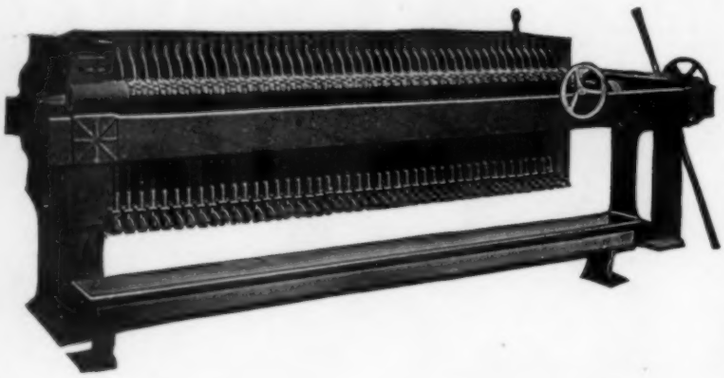

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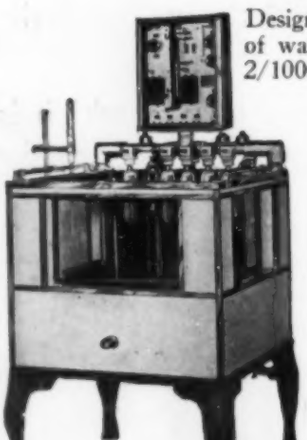

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CHEMICAL & METALLURGICAL ENGINEERING

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Superpower Development And Engineering Co-operation

THERE seems to be a myopia inherent in each branch of engineering that prevents the engineer from viewing a problem other than in the light of his own specialty. Particularly is this true with reference to the many discussions, public and private, of the growing power needs of the country and the means of meeting them. Attention has been focused on this problem by the government's superpower survey in the Northeastern states.

One point brought out in this survey has been the subject of much diversity of opinion and well serves to illustrate the preceding criticism. It was suggested that large power plants be located at the mine mouths and the resulting electric current distributed in the place of the raw coal. Immediately the power plant engineer arises and says, "Impossible! Where would it be possible to find any great supply of coal located close to a sufficient supply of condensing water to make such a plant possible?" With this objection he seems to feel that the matter is closed. The only gains from lessened coal transportation costs that he visualizes are those due to electrification of railroads and the more efficient use of coal when burned in huge central stations rather than in small industrial plants.

Viewing this argument in the light of the possible means of power generation available, it seems to us that the power plant experts miss the real solution of the mine mouth generation problem. In the first place, to transport raw coal, even to a highly efficient steam-electric generating central station, is an economic waste. Again, electric power can be efficiently generated at any point with gas and oil engines, because these are not dependent on a copious supply of condensing water. Incidentally, also, such machines can be operated at a thermal efficiency higher than any yet reached in the steam-electric plant. The byproducts of such power generation, coke, ammonium sulphate, heavy tar and so on, find a ready market and, if available at a lower price than now prevails, could be sold in vastly greater quantities. Also, they are less in bulk and higher in price than raw coal, thus presenting a much more attractive proposition for the railroads to handle.

The obvious objection to this scheme, raised by power engineers to whom it has been presented, is the high cost of equipment for carbonizing the coal. This is undoubtedly a fact; but, without going into lengthy cost analyses, it is also a fact that the byproducts of the process will carry the extra investment at a profit, as has been the case in many plants making fuel gas by the byproduct coking process.

In the light of this situation, it seems to us the obvious need that the chemical engineers of the country, who realize the importance, to the advancement of chemical industry, of an adequate supply of coal products, work with the power plant engineers to realize this development. A successful attainment of this end would be a great benefit to the engineering profession and an immense industrial advantage to the nation.

Scholastic and Professional Success in Engineering

IT HAS been a favorite theme in novel and drama to lift the unpromising student to wealth, power and influence. And there is no question that success in many fields of activity may be attained in spite of negligible scholastic standing. In the case of engineering, however, good scholastic work and good professional work go hand in hand. Interesting substantiation of this may be had from the following statistics.

Of 739 professionally eminent engineers, nearly 80 per cent are graduates of engineering schools, colleges or universities. That is significant. Much more significant, however, is the analysis of the scholastic standing of 392 eminent engineers whose records were available. Nearly half, 182 or 46.4 per cent, stood in the highest fifth of their classes upon graduation; 109 or 27.8 per cent were in the second fifth; 72 or 18.3 per cent were in the middle fifth, and only 29 or 7.4 per cent were in the lower two fifths.

These data presented in the *Bulletin* of the Society for the Promotion of Engineering Education (May, 1924) offer food for thought. Certainly they prove that a good student is more likely to become an eminent engineer than is a mediocre student. How much further we can go in this reasoning is a matter of individual judgment, but at least it deserves the attention of the engineering students of the country. As engineers we can perhaps bring it to their attention in the proper light.

Return The Courtesy

UNWILLINGNESS on the part of some industries to disseminate technical information irrespective of its nature indicates a narrow industrial vision. Refusal to assume responsibility for a share in technical progress is as unwholesome an indication of character in a company or industry as in an individual. It is only fair that for knowledge and information obtained from other sources a reasonable amount should be given in exchange, and yet it is too often the case that an industry that has been unusually acquisitive flatly refuses a request for technical information of a similar character.

Assuming that we had no progressive, fair-minded industries, firmly believing that a reasonable amount of technical publicity is worth while, an impasse would obviously exist. Technical and scientific associations would no longer thrive and that part of the press de-

voted to industrial advance would cease to have a reason for existence. Under such an order every plant would be self-sufficient, but progress would be painfully slow.

At least two industries in the chemical engineering group belong to that ancient and conservative order in which these conditions exist. In one notable exception no hesitancy is shown in seeking information, but a positive refusal to give in exchange is invariable. It is clear that the desire exists to maintain an open door for incoming technology, a barred exit for outgoing data of all kinds. Such a course is not only selfish and unfair but in the future will prove to be based on a fallacy.

The existing condition could be much improved without danger of unfortunate consequences. No harm can come from the release of general information on operating methods, especially for the benefit of outside industries. Competitors cannot use this to advantage, while plants engaged in entirely different lines of production may profit without loss to the plant or plants giving it out. Much fundamental information on process work exists in scattered quarters that is practically worthless in its present form. Should this be presented to the engineering public, fragments might be pieced together to the mutual advantage of all concerned. If the giving out of material for general publication were regarded with reason instead of with superstition, it would be found that practically the only undesirable data to release would be in the nature of detailed information on highly specialized processes. Eventually the worst offenders must rouse to these facts.

Reorganizing the Government Departments

FOUR years ago when the sloganists were talking most about "more business in government and less government in business," Congress appointed a Joint Committee on the Reorganization of the Executive Departments. The work to be done was evident, but so too were the many obstacles—political and otherwise—that lay in the path of the committee. After a long period of study, negotiation and compromise, the committee has finally given its report and recommendations for new legislation to the Senate. The subject is of such national importance that the committee's conclusions are deserving of careful consideration, particularly by the engineering profession, which from the beginning has taken an active interest in all attempts to place the conduct of government business on a more efficient and economical basis.

One does not need to have been a close student of government business to have observed the archaic, illogical structure of many of the executive departments. They represent the conglomerate result of a process by which each successive Congress has added or subtracted duties, bureaus and subdivisions in order to meet some pressing need of the moment or to satisfy some whim of politics. Occasional duplication of activities has been the natural result, and for correcting this condition minor rearrangements have gone on continually. Yet there has never been anything that could be regarded as a thorough overhauling of the government machine. Nor, for that matter, is the present effort much more than the mere beginning of such a process. The committee's recommendations are for the most part but a modification of the plan submitted to the chairman on Feb. 13, 1923, by the President and his Cabinet.

The Harding plan, it will be recalled, co-ordinated the military and naval establishments under a single Cabinet officer in a Department of National Defense, and created a new Department of Education and Welfare, to which various existing bureaus were transferred. Its principal changes, from an engineering standpoint, were concerned with the Department of the Interior, which was given two major functions—the administration of the public domain and the construction and maintenance of public works. The Bureau of Mines and the Patent Office, fitting into neither of the two categories, were to be transferred to the Department of Commerce, but in their stead the Interior Department was to take over the non-military activities of the War Department, the Supervising Architect's office from the Treasury, the Bureau of Public Roads from the Agricultural Department and the Federal Power Commission, an independent establishment. Other important changes would have established the existing General Supply Committee as an independent Bureau of Purchase and Supply, and would have given similar status to the Bureau of the Budget. The name of the Census Bureau of the Department of Commerce was to be changed to the Bureau of Federal Statistics and its scope broadened to include the statistical work on mineral production and waterborne commerce now handled by the Geological Survey and the War Department.

Practically all of the features of the President's plan, with the exception of the army-navy consolidation, appear in the final recommendations of the Joint Committee. Apparently the political mêlée precipitated by the proposed Department of National Defense had its effect on the committee, even though many logical arguments could be marshaled to the support of the consolidation. Neither the original plan nor the committee's modification provided for the establishment of a new Department of Public Works—a course strongly recommended by practically all of the larger engineering societies, which saw in such a move a desirable concentration of closely related engineering activities. The committee's recommendation to bring together these agencies in the Department of the Interior, under the direction of an Assistant Secretary for Public Works, is at best a compromise. It remains to be seen whether or not eventually the tail will wag the dog.

The recommended disposition of the Bureau of Mines raises another moot question among technical men familiar with the activities of this agency. None would question Secretary Hoover's unusual fitness for directing this bureau, yet its function seems more closely related to the natural resources and to the work of the Geological Survey than to the development of commerce. Likewise the Patent Office, although closely related to industry, serves a quasi-judicial function so different from that of the other bureaus as to entitle it, it would seem, to an independent status.

With these exceptions the committee report has much in its favor. The new Department of Education and Relief is distinctly a promise of better co-ordinated work along important lines that in the past have suffered from the lack of adequate direction. The independent Bureau of Purchase and Supply should be in a position to effect marked economies if we are to judge from the beginnings already made in the interdepartmental General Supply Committee. The new

Bureau of Federal Statistics will give a broader opportunity for the Department of Commerce in its already improved statistical service to the industries. All in all, the plan has much of real merit in it. To the next session of Congress it offers the basis for a piece of constructive legislation of great national significance.

Electrical Heating And Production Efficiency

ALTHOUGH heating by electricity was first developed for industries with demands that made impossible the use of other forms of heat, today it would be difficult to exaggerate its importance to all of the process industries. With the perfecting of design, heat application and control undergone by electrical heating equipment during the World War, many industries formerly using heat from combustion furnaces or from steam are now able, through the use of this equipment, to produce a greater quantity of higher grade product than had ever before been thought possible. And the field for this equipment is gradually being extended, so that more industries may take advantage of the opportunities for improved production efficiency that its use permits.

With these facts in mind, the series of articles commencing in this issue of *Chem. & Met.* on electric heating furnaces should prove of particular value. The first and second of these articles cover the use of the metallic resistor furnace. Other discussions to follow in later issues will treat of other phases of the application of electric heat. The series should present, to those unfamiliar with the possibilities of this method of processing, a suggestive and helpful ensemble.

"Heat Resistance" or "Hot Oxidation Resistance"

WHAT is meant by "heat resistance" as applied to metals? A growing looseness in the use of this term prompts us to offer a definition. Recently we found that several engineers with whom we talked took "heat resistance" to mean resistance to oxidation at high temperatures and nothing more. Resistance to hot oxidation is an important phase of heat resistance, but it is by no means the whole story. That a metal shall retain its strength when subjected to high temperatures is often fully as important as its resistance to oxidation; indeed, it is sometimes more important.

A standard steel beam at 1,500 deg. F. would support only one-tenth the weight it safely bears at room temperature. There are cases where corrosion resistance is a negligible factor, but where a slender beam of some special alloy must carry a heavy load at a red heat without bending appreciably. It would be correct to call this beam "heat resisting." It is also undoubtedly correct to call a metal heat resisting if it resists oxidation at high temperatures. This use of the term is not, in the eyes of the purist, strictly accurate, but usage has made it pardonable.

All of which leads to the conclusion that "heat resistance" means more than one thing. When a term is thus broad in its meaning it should be used with discretion. When resistance to oxidation at high temperatures is meant, "hot oxidation resistance" is the phrase to use. When a broader interpretation is intended, the broader term can be safely applied. If nothing but resistance to the weakening effect of heat is to be expressed, as many words can be used as are necessary to make the meaning clear, for it is not often that this occasion will arise.

Fortunately most metals that remain strong at high temperatures are largely resistant to hot oxidation. The converse is not true, however, and confusion will be avoided and accurate communication of thought will be enhanced by the use of the narrower term "hot oxidation resistance" when the narrower meaning is to be expressed.

Carrying Chemical Engineering Directly to the Industry

AT OUR request Prof. R. S. McCaffery, of the metallurgical department of the University of Wisconsin, has described on page 958 of this issue a unique experiment in graduate education. The success that has attended this novel course leads us to believe that it represents an example of definite service to industry well worthy of emulation by other of our educational institutions. Particularly attractive is the opportunity in the field of chemical engineering.

Briefly, the Wisconsin plan provides, in an industrial center such as Milwaukee, highly specialized graduate instruction for a limited group of engineers already employed in closely related commercial work. A 3-hour seminar is held every Friday evening and on the following day the instructors visit the different plants in order to discuss with the individual students the progress and problems of their research projects. The subjects being investigated have to do with industrial problems of very practical importance to the firms employing the engineers. This, of course, is one of the reasons why the industries concerned have been more than willing to provide financial support for the course and to give their time and facilities for carrying forward the research and study. The advantages accruing to the individuals who thus see and use the direct application of science in solving everyday problems of production are too apparent for further comment. We should not lose sight of the fact, however, that the university itself is greatly benefited by any such arrangement that brings its instructors into so intimate contact with both the scientific and practical demand of the industries.

To the chemical engineering departments of our educational institutions the plan is pregnant with suggestions. The opportunity — indeed the need — for organizing graduate classes in close co-operation with local industries is both an invitation and a responsibility. Chemical engineering is developing so rapidly that there are many graduate engineers in our industries who would heartily welcome a chance to take advantage of instruction in modern science and technology. Some of our universities, because of their strategic location or the personnel of their instructional staffs, are peculiarly capable of giving valuable extramural courses along specialized industrial lines. The same sort of specialization that is seen in undergraduate instruction in sugar technology at Louisiana, in pulp and paper at Maine, coal processing at Illinois, paint and varnish at Pratt and at North Dakota, could be made a much greater service to industry if carried directly to the industrial plants and applied to the solution of practical production problems. The results of Wisconsin's experiments in metallurgy can and should be duplicated on a large scale in chemical engineering.

The Metallic Resistor in Industrial Heating Furnaces

The First of Two Articles Dealing With the Application and Design of Electrical Heating Equipment

By E. F. Collins

Consulting Engineer, Industrial Heating, General Electric Co., Schenectady, N. Y.

SOME of the more important features of electric heating equipment that distinguish it from fuel-fired equipment are the following:

Heat Generation:

1. Released at points to give uniform or non-uniform temperature as desired.
2. Heat generation balanced against heat absorption.
3. Heat generated at or near potential of heating chamber.
4. Generated in inactive or dead atmosphere—no contamination of charge. Heating chamber may be a vacuum or under heavy pressure. Artificial atmosphere possible, as hydrogen gas, nitrogen gas, and no combustion gases.

Heat Conservation Resulting in High Thermal Efficiency:

1. High heat lagging, no local high temperatures.
2. Small heating chamber and no combustion chamber.
3. No hot gases leaving furnace, save for ventilation (when necessary).
4. Automatic control of temperature so that supply balances demand.

Method of Electric Heat Transmission and Delivery to Charge:

1. Convection of liquids and gases (natural).
2. Circulation of liquids and gases (forced).
3. Radiation and convection in air.
4. Direct radiation to work.
5. Direct and reflected radiation to work.
6. Heat generated directly in charge by current flowing through it.
7. Complete heat saturation of charge without surface overheating, due to perfect automatic heat control.

In the electric furnace, heat generation can be kept nicely balanced against heat absorption by the charge. The importance of this fact cannot be overemphasized, since the problem of heat absorption is of first importance in all heating, and especially in combustion furnaces. Efficient generation or development of heat units by chemical oxidation means little unless the heat released is in a minimum constant proportion to the heat absorbed in doing useful work. Hence the rate of heat generation and heat absorption must be skillfully controlled to guarantee maximum over-all efficiency. To burn fuel correctly is therefore only the first step that has an immediate bearing upon practical results. This very fundamental truth should be recognized by all furnace users.

The field for electric heat has grown until it is a large one. Fig. 1 shows in general this field laid out and more or less classified with respect to temperatures. In this paper it is purposed to deal only with electric heating as carried out by the use of metallic resistors. However, it is well first to define the general types and classes to be discussed and their relation to other types of resistance heaters.

HEAT TRANSFER

There is today perhaps no more important question before the production engineer in the process industries than that of the efficient utilization of heat. Recognizing this fact, *Chem. & Met.* plans to cover the field of fuels, heat production and heat application thoroughly. The accompanying article, part of this effort, deals with the important operation of heating by use of electric resistance heaters. Particular attention is paid to the use of the metallic resistors, and numerous examples from industrial practice show well how this type of equipment is applied.

A UNIT PROCESS OF CHEMICAL ENGINEERING

(*A*). Resistance heaters are those in which heat is developed by the passage of current through a solid, laminated, granular or liquid conducting medium.

1. The conducting medium may consist of material that is to be heat-treated. The heat is here generated at the point of utilization.

2. The heat developed by resistance is all or in part transferred to the charge by conduction, radiation or convection; a wall, muffle or baffle may or may not intervene between the heat-generating resistance and charge.

(*B*). Possible materials for heating resistors (see Fig. 1):

(*a*) Non-metallic "resistor."

1. Carborundum silundum.
2. Nernst, earth and oxides.
3. Solid carbon or graphite.
4. Granular carbon or graphite.
5. Current carrying liquids.

(*b*) Metallic "resistor."

1. Iron and steel.
2. Platinum.
3. German silver.
4. Tungsten.
5. Calorite or nickel-chromium alloys.

(*C*). Classification of present-day commercial devices offered for industrial use:

(*a*) Air and space heaters for heating to 1,000 deg. F. and for any required connected kilowatt capacity. System equipped with automatic temperature control, high efficiency and flexibility.

(*b*) Immersion heaters for liquids, etc., for moderate energy requirements, and equipped with automatic heat

controls, dependable and satisfactory for factory usage.

(*c*) Ovens of any desired capacity for operation below red heats—automatic control of heat, highly efficient and adapted to any heat cycle desired.

(*d*) Furnaces operating above red heats, usually automatic control of power and temperature, and provided with recording pyrometer.

(1) Non-metallic resistor:
  (*a*) Carbon plate.
  (*b*) Granular carbon.

(2) Metallic resistor—chrome-nickel alloy working at temperatures up to 2,000 deg. F.
  (*a*) Muffled resistor—round wire.
  (*b*) Unmuffled resistor—flat ribbon.

Applications of Electric Heat

Many successful working installations of electric heat exist today, and it is predicted that many more industrial processes will be improved and made more economically productive by the application of electrically generated heat. A few of the many such installations are illustrated herewith.

Fig. 2 shows a design for the application of electric heat to hot plates, hot presses, molds, vulcanizers, etc., which require alternate heating and cooling. The system is very simple and has a partial regenerative character, returning all heated oil to the tank before cooling the mold; thus it tends to require less cooling water, in addition to affording a saving of heat. This arrangement has a higher inherent thermal efficiency, especially at high temperatures, than if heated and cooled alternately by steam and water.

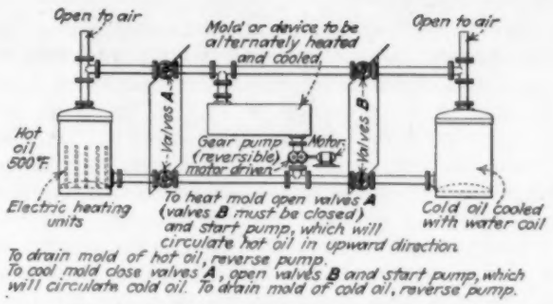

Open to air
Mold or device to be alternately heated and cooled
Open to air
Valves A
Valves B
Hot oil 500°F.
Gear pump (reversible) motor driven
Motor
Electric heating units
To heat mold open valves A (valves B must be closed) and start pump, which will circulate hot oil in upward direction.
Cold oil cooled with water coil
To drain mold of hot oil, reverse pump.
To cool mold close valves A, open valves B and start pump, which will circulate cold oil. To drain mold of cold oil, reverse pump.

Fig. 2—Electric Heating for Circulating Oil
Layout for heating device for molds, presses, vulcanizers, etc., using oil as a heat transfer medium.

Fig. 3 is a japan baking oven for telephone instrument parts. This oven is equipped with 18 kw. of heaters, and its dimensions are 7 ft. 10 in. high, 6 ft. wide and 6 ft. 3 in. deep.

Fig. 4 shows one of a battery of ovens in use for making automobile engine cores. Core weights vary from 3 to 128 lb. each. A very heavy linseed oil binder is used, which makes it necessary to provide ventilation and hence heat in excess of the requirements of the ordinary core compounds. The inside dimensions of the oven are 5 ft. wide, 10 ft. deep and 7 ft. high. The connected load in heaters is 86 kw. Automatic temperature control is used. A baking temperature of 425 deg. F. is used, which reduces the baking time from 1 to 3 hours over that required by the gas oven operating at 350 deg. F., the highest practical baking temperature with gas heating. Four of these ovens work at efficiencies varying from 10.9 to 14.6 lb. of

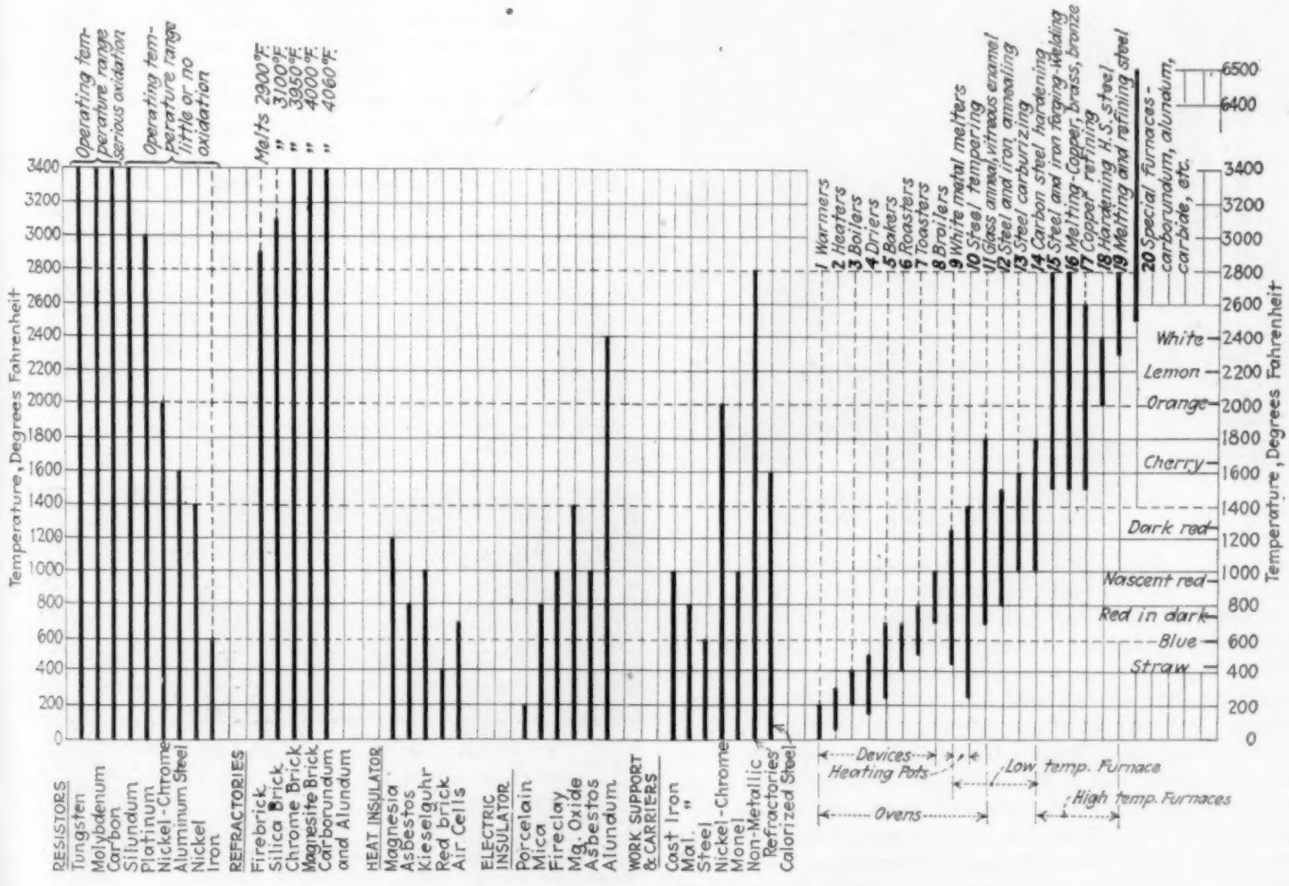


Fig. 1—Materials for Heating Resistors
A comparison of the industrial utility of various resistor materials for industrial heating equipment.

green cores baked per kw.-hr. of power consumed. The total cores baked in four ovens for 1 week were 108,730 lb., and the power consumption corresponded to 9,389 kw.-hr., giving an efficiency of 11.6 lb. of cores per kw.-hr. During a year period these ovens did not turn out a car of burned, cracked or imperfectly baked cores.

Electric heat makes a highly efficient protective zinc coating possible by the sherardizing process. Uniformity of coating and consequent long life is secured by virtue of the close control, which makes it possible to repeat the heat cycle again and again under the same conditions.

Fig. 5 illustrates a large japanning oven such as is used by automobile manufacturers to bake the finish on the cars. This oven has 300 kw. connected capacity, and work is carried through it continuously by conveyor. Ovens turning out a car per minute and requiring more than 3,000 kw. to heat have been in use for several years in one automatic shop. The electric baking of japan paints, lacquers, varnish, etc., has come to be considered a standard process in many lines of manufacture.

Tests made on the vertical type of electrically heated glass annealing lehr (Fig. 6) show a reduction in

Fig. 3—Small Electrically Heated Oven
Type of oven used for baking japan finish on telephone instruments

over-all cost of product of 20 per cent over that in the gas-heated lehr. This saving was equivalent to seventy-five times the cost of the electric power for heating the lehr. This type of lehr for annealing glass presents many positive advantages for rapid, uniform and economic annealing of most commercial glass. The box type oven or lehr, electrically heated, serves with equal advantage for other types of glass, including optical and telescopic lenses. Some of these advantages are as follows: (1) High thermal economy, (2) satisfactory heat distribution, (3) small floor space, (4) possibility of location near fabricator, receiving the ware at higher temperatures, (5) reduction in labor, (6) lack of opportunity for ware to absorb products of combus-

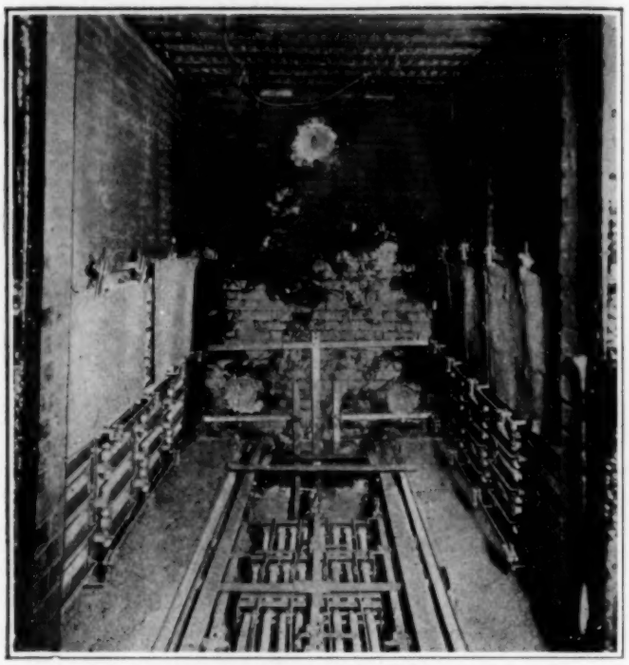


Fig. 4—Large Electrically Heated Oven
This type of oven is used for baking large cores for automobile engines.

tion, (7) low-temperature gradients, (8) automatic heat control (2.5 deg. C. may be secured), (9) annealing time less than one-half of the present-day fuel-fired lehr, (10) practical elimination of rejects, distortion and breakage due to heat-treatment, (11) freedom from sulphuring of the ware and the production of a bright polished surface requiring no subsequent cleaning and washing, and (12) a sterile and absolutely clean product, such that prescriptions (where this is important, as in medicinals) may be filled in and sealed immediately after leaving lehr.

Electrically heated furnaces are well adapted to baking vitreous enamels (Fig. 7). One of the chief disadvantages of the coal-, gas- or oil-fired furnace is that the muffle periodically sags and breaks, with resultant loss of product and of time for repairs. This is avoided in the electric furnace. Another disadvantage not met in the electric furnace is the presence of sulphur fumes. Furthermore, even distribution of heat can be obtained only with the electric installation. The furnace can be loaded from the rear wall almost to the door and burned down to a finish, leaving a clean white enamel.

Fig. 5—Electrically Heat Conveyor Type Oven
This type of japanning oven is used for continuous production processes such as finishing automobile bodies.

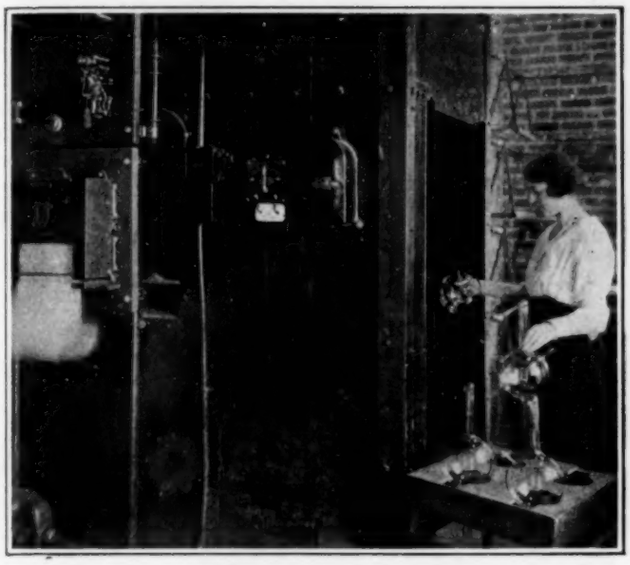


Fig. 6—Vertical Glass Annealing Lehr
The annealing of glass in electrically heated lehrs effects great savings in the production of commercial glassware.

The cost of the electric furnace may be higher in original investment, but the saving in space and cleanliness soon make the difference in price a matter of secondary importance. The power cost is also higher. However, with the additional output, tests show that the actual cost per pound of material heated will compare very favorably with any other form of fuel. When the electric furnace is able to handle at least 170 heats in 10 hours against 130 heats by the coal furnace, with a 25 per cent greater weight of charge and without a single reject, the comparison in cost of fuel assumes a different aspect and a value actually in favor of electric heat. The electric furnace can be brought from cold to 1,700 deg. F. in 12 hours. A coal furnace would require about 3 days, an oil furnace 24 hours and a gas furnace 16 to 20 hours. The outstanding features of the furnace have been the extreme speed at which it can be heated up and at which it can be operated. Heats have been completed in 1 minute 50 seconds that would have taken 3 minutes 40 seconds in an oil furnace.

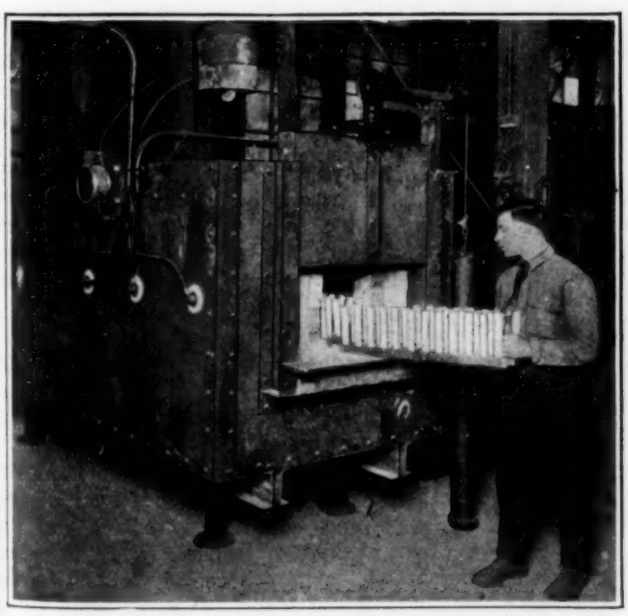


Fig. 7—Oven for Vitreous Enameling
For this type of work an oven is provided with two chambers, one for preheating and one for firing.

Comparison of Types of Resistors

The foregoing classification shows that a limited number of resistance furnace types have survived commercially and are available for industrial uses—viz., (1) the carbon plate resistor, (2) the granular carbon or graphite resistor, (3) the metallic resistor (usually nickel-chrome alloy).

The carbon plate resistor furnace has been built only in comparatively small sizes. A furnace with heating chamber floor 12x18 in. and requiring 30 kw. is considered a large furnace for this type of construction. The upkeep is high. It is necessary to renew resistor parts constantly. The life of electrodes and resistor plates ranges from 150 to 500 hours. This design, therefore, is limited to tool room, laboratory or other light work where interruption of production work is not important.

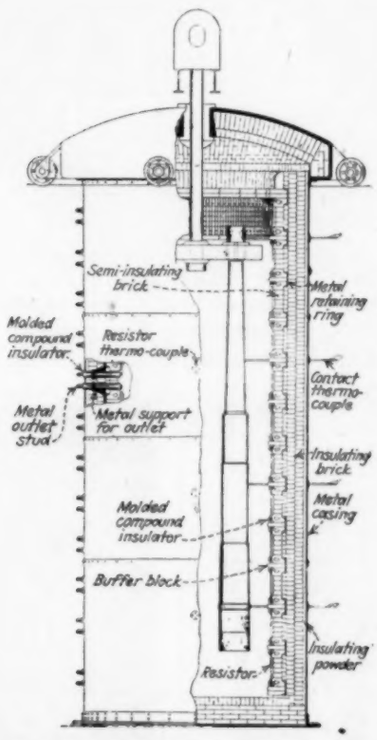


Fig. 8—Vertical Heat Treating Oven
This type of oven, used for heat-treating gun forgings, effected great savings during the World War.

The granular carbon resistor at one time seemed to offer a final solution for the construction of an industrial electric furnace of considerable merit. However, after several furnace engineers in this country and abroad had spent much time and money in skillful and ingenious attempts to realize the attributes necessary for a successful furnace, it became evident that it could not be seriously considered as an all-around commercial or economic possibility.

It is not the intention of this paper to discuss the troubles experienced with this furnace. A mere recounting of such troubles would require more space than it is desired to use. It is sufficient to say that this type of furnace frequently defaulted so seriously in its ability to meet efficiently many industrial heating needs

that it was abandoned, with few exceptions, by those engineers who had most persistently labored to make of it a successful "over-all" industrial tool.

Coming now to the early designs of the metallic resistor furnace, it is felt that its entering status can best be appreciated by noting some statements taken from the catalogs of furnace makers in the year 1914, as follows:

Construction—"The principal parts of this furnace are the muffle, the heat-producing element or wire resistor, the heat insulation material and the inclosing structure."

Heat Production—"Heat is produced by the resistance offered to the passage of an electric current through the resistor. From this point it is conducted through the adjacent cement and muffle directly into the furnace chamber. The regular distribution of the heating element over the surface of the muffle and in direct contact with it produces uniform heat intensity throughout the furnace chamber."

The Muffle—"This is a dense, refractory material lining the furnace chamber; it must be high in melting point, a good conductor of heat and mechanically strong. Fireclay, silica and alundum are materials applicable, the last named being generally preferred."

The Resistor—"This is in the form of a wire helix wound outside of the muffle, the whole covered with special cement of the same nature as the muffle so as to aid in the transfer of heat to and through the latter into the furnace chamber. The ends of the resistor are connected to the two terminals at the rear of the

Fig. 9—Resistor Ribbon for Electric Furnace

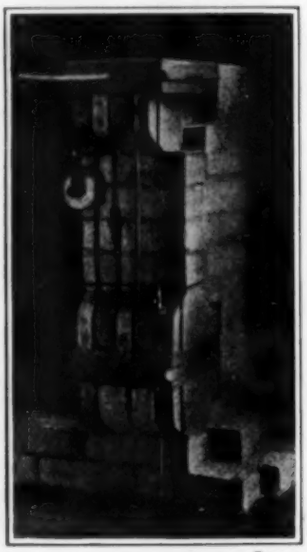


Fig. 10—Setting for Resistor Ribbon

furnace. The metal of which the resistor is formed is a patented resistance element, being an alloy of nickel and chromium."

Temperature Regulation—"The furnace operates safely at temperatures as high as 1,000 deg. C. (1,832 deg. F.). It will reach the melting point of gold (1,065 deg. C. or 1,949 deg. F.) with safety for short runs, but should never exceed this. With the front closed, the furnace being connected in circuit, the temperature in the chamber will gradually increase and eventually, on continuous operation thus, the winding will burn out.

"We strongly recommend the use of suitable rheostats with these furnaces for the purpose of controlling the current through the resistor and hence the temperature of the chamber.

"The use of a pyrometer in connection with this combination is desirable, as it will enable the operator to know at all times the exact temperature within the furnace chamber. This knowledge will enable him both to protect the furnace from untimely burn-outs by keeping below the temperature danger point and to get more uniform results in this work."

Life—"With care in avoiding excessive temperatures, the life of these furnaces should be at least 1,000 hours

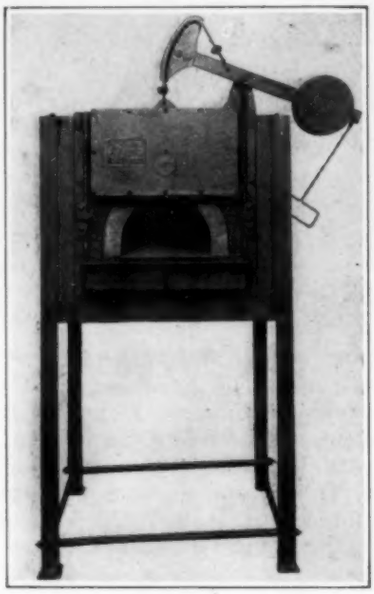


Fig. 11—Small Type Resistance Furnace

This is a general utility furnace for use in tool rooms or other similar places where high production is not a desideratum.

at the maximum temperature of 1,000 deg. C. (1,832 deg. F.), with a corresponding increased length of life at lower temperatures.

"In case of a burnout, the furnaces may be rewound at a moderate cost."

That such designs had many handicaps is proved by the very fact that furnaces of such construction had for years been considered and used only for laboratory and similar light work. They had never seriously challenged consideration for heavy production processes. It is hardly necessary to enumerate in detail all of the shortcomings of the foregoing design as a dependable industrial tool. We shall, however, point out modifications in design that enabled it to enter the large armament shop during the war.

Had the pre-war designs of the metallic resistance type of furnace been adhered to, this story would already have been told. Thanks, however, to the adoption of new methods of construction, based upon sound scientific principles, it was possible to lift the metallic resistor furnace—a mere pigmy—from the confines of the laboratory and enlist it—a giant, if you please, capable of efficient and continuous service—in the manufacture of war supplies, especially great naval and field guns of the largest bore. In other words, pre-war metallic "resistor" furnaces ranged from a few kilowatts capacity to perhaps 30 or 40 kw. at most, and heating chambers had capacities for only a few pounds or a few hundred pounds of material to be heated

at one charge. Revolutionary ideas in design and construction gave furnaces with metallic "resistors" requiring 250 to 2,700 kw. energy per furnace and heating chambers 4 to 10 ft. diameter and 10 to 100 ft. deep, capable of operation continuously at 1,500 to 1,600 deg. F. and receiving 10,000 to 300,000 lb. of gun tubes or jackets at one charge.

A revolutionary idea incorporated in the design was the location of the resistor ribbon, unmuffled, in the open heating chamber so that it might directly radiate the heat generated within it. These ribbons (Figs. 9 and 10) were very rugged mechanically; they were sometimes as much as 2 in. wide by $\frac{1}{8}$ in. thick and were formed into loops. They were supported on refractory insulating members projecting from the walls of the heating chamber, the body portions of the support being imbedded in the wall.

The resistor is thus free to deliver its heat by radiation to the charge without the necessity of first forcing the heat through the walls of a muffle, as had been the practice in most metal resistance furnaces theretofore constructed.

In order to force heat through a muffle at high rate and secure rapid heating of the charge, a high-temperature gradient and therefore high resistor temperature are necessary. Hence the unmuffled furnace had inherently a lower temperature resistor, produced quicker heating and was much less sluggish in point of temperature regulation than the muffled or screened furnace

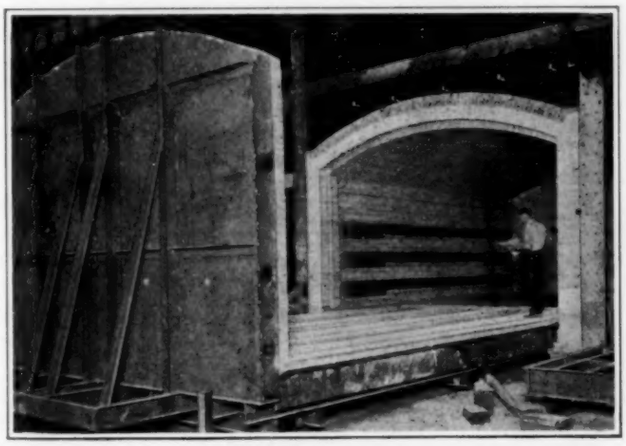


Fig. 12—Large Heat-Treating Furnace
This is an adaption of the furnace used for gun forgings having many uses in heat treating large work.

doing the same work. The unmuffled furnace used direct and reflected radiant heat.

Performance Records

A very complete set of records of performance of an installation of these electric furnaces shows results which may be summarized as follows:

Heating to 1,450 deg. F. Furnace hot when charged. Furnaces 6 ft. diameter by 24 ft. high, voltage 440, sixty cycles, capacity 400 kw. (see Fig. 8).

Charge		Total Weight, Including Holding Fixtures, Lb.	Energy in Kw.-Hr
Twelve	3-in. gun tubes	21,000	1,874
Seven	4-in. gun tubes	22,300	1,880
Three	4-in. jackets	21,700	2,088
Total		65,000	5,842

Average lb. per kw.-hr. ..... 65,000 ÷ 5,842 = 11.25
Kw.-hr. per ton ..... 2,000 ÷ 11.25 = 173
Energy cost per ton at $0.0085 per kw.-hr. ..... = $1.52

This shows what may be done with the electric furnace in moderate-scale operations. The time required to heat these charges was 5½ to 6 hours, and the maximum diameter of forgings was 16½ in. The furnaces were 24 ft. high by 6 ft. diameter inside dimensions, the connected load being 400 kw. each. The ultimate or minimum radiation from test was found to be 70 kw. The predicted radiation from design was 75 kw., a satisfactorily close agreement.

The actual operating results for the four furnaces for the month of October, 1918, when production was at the maximum rate, including both hardening at 1,450 deg.

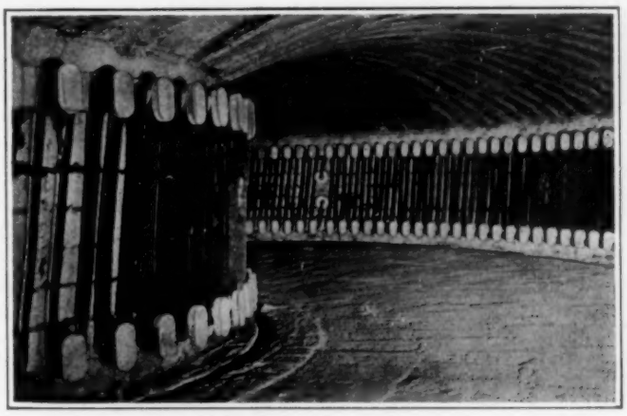


Fig. 13—Rotary Heating Furnace
A further adaption of the direct application of electrical heat. The moving hearth makes it available for continuous process work.

F. and drawing at 1,150 deg. F., was $2.76 per ton based on the power rate of $0.0085 per kw.-hr.

Some Advantages of the Furnace

A portable metallic resistor furnace (see Fig. 11), with a hearth dimension of 10.5 in. wide by 21 in. long, is ideally suited for annealing, hardening and tempering or drawing files or small tools in the ordinary tool room. It is likewise suited to any heating requirements where the charges do not require more than 1,800 deg. F. Some of its advantages over fuel-fired unmuffled furnaces are as follows: (1) Radiant heat, (2) satisfactory heat distribution, (3) automatic control of temperatures if desired, (4) practically non-oxidizing atmosphere if desired, (5) small amount of heat given off to the room, (6) no products of combustion or obnoxious gases given off to heating chamber or room, (7) ratio of heat generation to heat absorption by charge correctly maintained, (8) uniform and complete penetration of heat through charge without overheating of corners, fins or surfaces, (9) ability to repeat desired heat cycle, giving uniformity of product, (10) a reduction generally in labor, and (11) a better over-all economy and the production of higher quality product at the same or slightly higher cost or the same quality at a less over-all cost. A large type furnace is shown in Fig. 12.

Fig. 13 is a view of the interior heating units, hearth and walls of a furnace with a rotating hearth which is being used for heat-treating parts in an automobile factory. Its resistors are metallic and its temperature limit is 1,800 deg. F. It operates normally at 1,550 deg. F., three phase, 440 volts with 270 kw. connected capacity. The furnace has automatic temperature control and operates to heat such parts as engine crankshafts, etc.

Gassing Citrus Trees in Florida

Local Conditions Required Development of New Materials and Novel Methods of Application

By W. Lee Tanner
Field Investigator, Grasselli Chemical Co., Panasoffkee, Fla.

FUMIGATING with toxic vapors to control the ravages of citrus-tree parasites has been practiced in California on a large and successful scale for many years. In Florida, strange to say, the same degree of success has not been obtained as in California, even though the same gases and means of application were employed. It is only recently that a thorough study of the conditions existing in Florida as different from those of California has revealed the reasons for the poorer results and has made it possible to develop a material and methods suitable for the Florida conditions.

In California the fumigation of citrus trees is carried out in the winter time, when they are in a somewhat dormant condition. It might be mentioned here that in Florida citrus trees do not ever reach this degree of dormancy, since some new growth on the trees occurs in every month of the year. It was because of these flushes of growth that hydrocyanic acid gas fumigation in Florida always caused injury to the trees. However, other gases have been found applicable to Florida conditions.

The researches that have brought this about have been directed along two different lines, which are here described under separate heads: Fumigating groves without tenting of trees (the dispersoid method) and cloche fumigating, or the tent method.

Fumigating Without Tenting of Trees

The use of individual tents for each tree or plant requires a large and costly equipment, and the expense of maintenance is great. It was therefore desired to eliminate tents. A study of this problem resulted in the following list of requirements:

1. The dispersoid must be easily prepared or evolved where used.
2. The vapors or gases must condense promptly to liquids, which come to rest at once on the vegetation, where they should remain.
3. The dispersoidal substances must be toxic to the insects and fungi to be combated and non-toxic to the operators and their animal help.
4. The condensate or dispersoid should cling tenaciously to the vegetation and engage in eradicating the pests through a considerable period of time, so any young insects or crawlers as well as new fungi spores coming after the main application would be destroyed.

The first requirement was quickly solved. A package containing the chemical agents engendering the dispersoidal toxic substances was invented and consists of the following units: (1) The chemicals from which are evolved the toxic dispersoids when a certain degree of heat is applied. (2) The combustible substances that supply the necessary heat upon ignition. (3) The controlling substance for modifying the combustion and enabling the evolution of the dispersoid to take place uniformly and prevent any destruction of the toxic substances.

The materials actually used in "Vapocide" (copyrighted by the Grasselli Chemical Co., 1922) consists of: Phenarsazine chloride, paradichlorbenzene, methyldichloramine in special absorbent, sodium nitrate, magnesium carbonate and wood meal properly apportioned, mixed and packed under pressure in metallic containers, and provided with a slow match head for conveniently igniting the combustibles.

The vapors and condensates evolved by this charge are exceedingly toxic to insects and though repulsive to the operators are not greatly harmful to them. The strong odor and other properties of the gases and sub-

Individual Cloche of "Doped" Cloth for Use in Applying Methyldichloramine Fumigation

limates easily tend to drive the operators and help out of the harming zone.

The charges are put up in various sizes to suit different uses. For example, a large-scale test was made with excellent results in a big eucalyptus grove against web-worms and other moths and larvæ, where the charge was very great per unit, being 10 lb. gross weight in this instance. The trees were 50 ft. high and close together, making a dense growth.

Certain meterological conditions, especially for wind and humidity, are required for the best results and economy of application by this method. These are being worked out for the various kinds of vegetation and climate.

Cloche or Tent Method

Where individual trees or plants are to be treated as in the California method, different materials and modes of application has been developed to meet successfully the Florida conditions.

A great many vapors and condensates were carefully investigated to find a material giving best results as an insecticide and as nearly harmless as possible to the vegetation, tree or plant metabolism. The materials at the top of the list are: (1) Methyldichloramine, (2) methyl nitrile, (3) methyl cyanide, (4) cyanogen chloride, (5) paradichlorbenzene.

Methyldichloramine is the most satisfactory in every respect. Orange trees subjected to a concentration of 30 grams per cubic meter (volume in cloche) of the gas were relieved of every insect by a 30-minute application, and the trees suffered no injury whatever.

Methyldichloramine is put up in special applicators which conveniently vaporize it and as the patent appli-

cations covering the device have not all been filed, no description of them will be given here.

A package containing methylamine-hydrochloride, bleaching powder and lime to which water is added at the time of application is also specified in the patents. In this case methyldichloramine is produced by chemical reaction and the heat produced serves to vaporize it as formed; no combustibles are needed. Other substances than methyldichloramine are formed, but do not influence the results greatly.

The cloches or tents used have also been improved over those in past use, there being a convenient ladder equipment permitting one man to raise a tent easily over the highest citrus tree more rapidly than with the older outfits.

Legal Notes

By Wellington Gustin
Of the Chicago Bar

Compensation if Orders Are Disobeyed

Injury Received While Fulfilling Duties of Employment Creates Liability Without Question of Fault on Part of Employer or Employee

In an action brought for compensation against the Imperial Brass Manufacturing Co. in Illinois the Supreme Court of that state has held that an employee's death from using a forbidden chemical in cleaning about the premises was within the compensation act and compensable. (137 N. E. 411.)

It appears that the employee inhaled fumes of sulphuric acid which he was using for cleaning purposes, causing his death. There was evidence tending to show that he was forbidden to use the acid and was directed to use a cleaning compound instead, which direction or order he had disobeyed. This cleaning was found to be in the course of his employment, it being what he was hired to do. And the question arose whether the violation of the employer's order not to use the acid took him out of the sphere of his employment and deprived him of the protection granted by the compensation act.

Rule as Laid Down by Court

The rule was laid down in a previous case, 302 Illinois Reports, page 401, brought by the Republic Iron & Steel Co. against the Industrial Commission, as follows:

"Where the violation of a rule or order of the employer takes the employee entirely out of the sphere of his employment and he is injured while violating such rule or order, it cannot be then said that the accident arose out of the employment, and in such a case no compensation can be recovered. If, however, in violating such a rule or order the employee does not put himself out of the sphere of his employment, so that it may be said he is not acting in the course of it, he is only guilty of negligence in violating such rule or order and recovery is not thereby barred. It does not matter in the slightest degree how many orders the employee disobeys or how bad his conduct may have been if he was still acting in the sphere of his employment and in the course of it the accident arose out of it."

In another case, Richards versus Indianapolis Abattoir Co., 92 Connecticut Reports, page 274, the court there says:

"An injury to an employee may be said to arise 'in the course of his employment' when it occurs within the period of his employment, at a place where he reasonably may be, and while he is reasonably fulfilling the duties of his employment, or is engaged in doing something incidental to it."

And in still another case the court says:

"The liability imposed by the workmen's compensation act has no connection with the negligence of either the employer or the employee. An injury arising out of and in the course of the employment creates the liability without any question of fault on the part of either the employer or the employee." .(276 Illinois 472).

Credit Clause in Oil Contract

Court Holds Good Faith Must Be Shown in Determining Buyer's Financial Condition Before Refusing to Make Further Deliveries Except for Cash

The Midland Linseed Products Co. brought an action in the federal court against the Charles R. Sargent Co. for the recovery of damages for the breach of five separate contracts for the sale and delivery of specified quantities of pure linseed oil and for an account for oil sold and delivered. The defendant denied any breach of the contracts of sale, and filed a cross-petition alleging breach of these same contracts by the plaintiff.

The contracts were for the sale of 500 bbl. of linseed oil, to be shipped on orders of the buyer and paid for within 10 days after shipment, with discount, or by 30-day trade acceptances. They also provided that, "in case of default in payment of any installment of purchase money when due, or in case the credit of the buyer becomes unsatisfactory to the seller, the whole sum owing by the buyer shall become due at once and further deliveries shall be made only for cash."

The trial court's judgment for the buyer upon the five contracts was reversed by the Court of Appeals of the United States.

Further, on the question as to the right of the seller to determine that buyer's credit was impaired, the court said this presented a question of fact to be determined from evidence. Notwithstanding the contract provides that in case the credit of the buyer becomes unsatisfactory to the seller further deliveries will be only for cash, nevertheless, says the court, this provision does not confer upon the seller authority to declare arbitrarily that the buyer's credit is unsatisfactory to it. It is averred in the petition that: "Acting in good faith upon facts and circumstances arising subsequent to the making of the said contract, plaintiff became dissatisfied with defendant's financial condition, and defendant's credit so became unsatisfactory to plaintiff."

Defendant denied this in its answer to the suit, and the court said this placed the burden of proof to establish the truth of this averment by a preponderance of the evidence. If the plaintiff fails to do this, then it cannot recover on any of the five counts, says the court. And its refusal to make further deliveries, except only for cash, would be a breach of contract on its part for which the defendant would be entitled to recover. Therefore, the case was remanded for a new trial.

Fundamental Economies of Material Handling

Abstract of Paper Read Before the Spring Meeting of the A.S.M.E. in Cleveland, May 27, 1924, Summarizes Advantages That May Be Attained

By M. L. Begeman
Professor of Mechanical Engineering, University of Michigan

EVERY industrial organization looking toward maximum economy must include in its program a careful study of the handling of its materials. Competition is keen, unskilled labor expensive, and while in other departments economies have long been practiced, here is a profitable field for developing greater efficiency.

The handling of material in a plant by machinery is by no means a new idea. Many industries employing continuous processes have over a period of years developed this phase of engineering to a high degree of efficiency. The definite continuous flow of their product made it easy to select a type of handling equipment to meet their needs. Other industries whose products are heavy or bulky have developed the art of mechanical handling because of the physical impossibility of handling their product by any other means. The steel industry is a good example of this type. Many industries having a more complicated flow of product or a variety of product have, of course, been slower in adopting mechanical equipment.

In spite, however, of the advantages demonstrated by these developments in the mechanical handling of material, the great majority of the industries have so concentrated their efforts to their processes, their equipment and their management in general that they have entirely overlooked the vast economies possible by proper movement of material and product. One does not have to look far to find the wheelbarrow still laboriously doing duty or to see some perfected process machine with the floor on either side being used for raw materials and finished products. Competition will not allow such wasteful methods long to continue. Even now it is difficult to secure unskilled labor to push these wheelbarrows or to carry material by hand.

Moreover, as one looks toward the future, the prospect for an increasing supply of laborers is not at all bright. Since the immigration restriction bill signed by President Harding, May 19, 1921, has gone into effect, the supply of laborers from abroad has been decreased. The restriction, which is based on the census of 1910, limits to a great extent the southern and eastern European immigrant—the type of immigrant that in the past has been largely used for the unskilled handling work in industries. The tendency is toward still further restrictions of that type of immigration, as manifested in the recent proposal to base the restriction upon the census of 1890, allowing immigration from each country equal to 2 per cent of the people of that nationality in the United States at that date. This cuts down the number of possible immigrants from southern and eastern Europe tremendously, but still maintains relatively large quotas from such countries as Great Britain, Germany, Norway and other western European countries. The average immigrant from these countries is better educated than the southern or eastern European immigrants and less apt to fall into the laboring class. It is also worth noting that more skilled labor has entered this country than has departed each year since 1910, while almost the reverse is true regarding unskilled labor. During the years 1915, 1918, 1919, 1920 and 1922 there has been an excess of departures over admissions, and this has caused a large decrease in the available supply of laborers. If the emigrations continue at the same rate under present restrictions, industry will no longer be able to depend on immigration as an important source of labor supply.

One condition that has delayed a general recognition of the need of material handling equipment is the fact that it is difficult to point out specific inefficiencies. Even now in those industries using mechanical equipment it is estimated that not more than 5 per cent are using such equipment to its best advantage. This is partly due to the fact that most cost systems class handling work as a non-productive operation and as such it receives little attention. The cost of various handling operations is not itemized and there are no data available from which to make an analysis. The handling labor is hidden away in the overhead charges and is looked upon as a necessary evil rather than an unnecessary loss.

It may be safely said that there is not an industry which does not have need for some type of handling equipment. The general cycle of all manufacturing plants is about the same. Materials are first received and put into temporary storage. From storage they go to production and while there move from one machine

MATERIAL HANDLING

Various articles, published in *Chem & Met.* and elsewhere, have pointed out different advantages that may be gained by the proper use of material handling equipment. In the article presented herewith, Professor Begeman has collected all these facts and presents them, for the first time, in one comprehensive discussion. We do not believe that there yet remains any question in the industrialist's mind that mechanical handling is profitable. But the present article, by pointing out just where the profit may be looked for, should do a service in enabling the executive to determine just how profitable it will be in his particular case.

A UNIT PROCESS OF CHEMICAL ENGINEERING

or operation to another, and often from one department to another. Leaving the production departments, the product goes to finished stores. From the finished-stores department it is shipped out of the plant, thus completing the cycle of movements so far as the manufacturing plant is concerned.

Considering this cycle it is to be noted that it involves both movements and rests. In other words, the storage bears a close relationship to the handling system, and merely represents a halting place in the general process of movement. Hence in the study of material movements the question of storage must also be taken into account. Equipment selected must not only handle the materials economically but should also facilitate their handling in and out of storage and if possible reduce the time in storage.

Present-day manufacturing equipment consists of but two main divisions: the production equipment which performs the various operations and the equipment which serves to bring the material to and from the production machines. Machines and processes of the first type have in the past received most of the attention and as a result have been perfected to a high degree. It remains, then, that any economies practiced will be concerned largely with the handling equipment. Many manufacturers who have highly developed automatic machines and an otherwise efficient organization are losing much of the value of their development by discounting the importance of factory internal transportation.

Although the handling equipment has not come into use nearly as much as it should, it certainly is not because such equipment has lacked development and perfection. The last 10 or 15 years has seen a great improvement of this type of equipment. Manufacturers have brought about much standardization along this line and are continually investigating new possibilities for labor saving. Special problems that come up are given special analysis and equipment is designed, if necessary, that will meet the needs presented. Manufacturers who have not kept up with the rapid development of this type of equipment have only to present their problem to engineers in this work and new avenues of economies will be opened up for them.

Economies Effected

The economies effected by a properly installed handling system reach practically every department of an industry. It is most directly concerned, of course, with the production operations.

Increased Production, the first important economy to be realized, is brought about by the elimination of certain delays and by general improvement of the material routing through the plant. By eliminating the lifting and carrying of material by workers and effecting its movement by mechanical conveyors, material is brought to the machinery at the desired rate for best operation. Delays caused by tardy arrival of material are common when relying on human effort for the supply. With properly installed mechanical equipment the product as it is finished is immediately moved on, preventing accumulation and cluttering of floor space.

Increased Speed. The first important economy to be effected by the use of material handling equipment is, as has been shown, the increase in production. Along with increased production, material handling equipment also brings about a greater speed in the movement of the product through the plant. These two benefits are very closely related and to some extent are dependent upon each other. However, in many cases the essential requirement is speed, and for this reason it may be mentioned separately as one of the benefits of material handling equipment.

Perhaps the most valuable result of increased speed in moving the materials about is that less material is required at any one time in the process of manufacture. Cutting down the inventories of the goods in process helps to bring about a rapid turnover in the plant and permits operating with a minimum amount of capital. This fact is appreciated if it is kept in mind that idle material is a dead investment, the interest on which represents a total loss.

Reduced Labor Expense. Another economy is due to the fact that material handling equipment usually reduces the personnel necessary to operate, and thereby reduces the labor expense. This is perhaps the reason for its installation in many instances. When labor is scarce and wages are high, the need for labor-saving equipment is brought to the attention of executives most forcibly. Frequently installations that will eliminate labor expense are recommended without giving any consideration to the other economies that follow.

In many industries, such as those manufacturing cement, sugar, flour or chemicals, the processes are standardized and the manufacturing problem is largely one of bringing the materials to the various processes and disposing of the product after the operation is complete. A large proportion of the labor used in such a plant is unskilled, employed merely for the purpose of trucking the material about the plant. The production cost would necessarily be, to a large extent, proportional to the cost of handling material, and hence any saving in labor is a saving in the production costs. Failure to take advantage of this possibility for economy either imposes a heavy penalty on the profits of the industry or increases the cost of the article to the consumer.

Aside from the fact that the labor expense is reduced by the substitution of mechanical equipment for laborers, there are other reasons for reducing the personnel to the lowest number possible. Plants equipped with handling equipment have a better class of workers, as it is the unskilled men and the shirkers that are mostly eliminated. The labor turnover is reduced by the removal of this type of employee and by the improved working conditions. Relieving the employee of physical labor makes his work more pleasant and enables him to work to his best advantage. Accidents are decreased as improvements are made in the working equipment. Cleaner surroundings and lack of confusion are also the direct results of handling equipment and tend to improve further the morale of the employees.

In times of labor shortage, cutting down the personnel to the lowest number possible helps materially to relieve conditions throughout the plant. The jobs replaced by material handling equipment permit using the few men available for more productive work.

Many examples could be cited showing actual labor savings that have been made by various manufacturers. In every case the figures prove that mechanical power in handling material is cheaper than man power.

Increased Storage Space. Material handling equipment economizes floor space. This is another important point in its favor. Floor space used improperly cuts profits as much as wasted time. The use of certain

types of elevating and tiering devices assists materially in economizing storage space. Too often the storage space is measured only by the floor space and little regard is given to the space above. As a matter of fact, the proper use of this overhead space frequently has the effect of doubling the floor space. In many plants and warehouses materials have not been piled high on account of the high labor cost involved. However, handling equipment is now available that will permit the piling of materials to the ceiling with greater ease than hand handling at any height. This equipment makes all the space in the room, excepting that necessary for aisles, available for storage. Practicing economy of storage space to this extent often saves the initial expense of additional floor space.

The use of material handling equipment for economizing storage space applies to railway terminals and large warehouses as well as to industrial plants. Investigation has often revealed the fact that the terminal charges are many times the haulage charges, particularly in the case of short hauls. Shipments coming in have to be unloaded, put into storage, separated and classified for reshipment, and finally loaded again and shipped from the terminal. Poor use of space has several bad effects. Incoming shipments cannot be unloaded if the warehouse, due to unwise use of the space available, is in a crowded condition. As a consequence the railroad cars themselves must act as a temporary storage, which ties up much of the yard trackage and removes from circulation part of the railroad equipment. Such conditions add to the final cost of the product. The demurrage charges and loss due to idle equipment must eventually be paid by the purchaser.

Decreased Overhead Expense. A very definite saving in overhead expense usually results when material handling equipment is installed in a plant. The importance of including burden or overhead charges in the consideration of material handling problems is emphasized in the formulas for calculating economies recently adopted by the Material Handling Division of the A.S.M.E. It is stated in the report of the committee that while it has been customary to charge factory overhead to factory handling equipment it has not been customary to credit the equipment for its portion of the burden saved. The discussion brought out the point that the omission of this item is frequently the cause of wide differences in the estimates when the same problem is being figured on by several concerns. In most cases this omission of credit is the result of a poor cost system. The handling expense is seldom distributed with respect to various operations or processes, but appears only as a lump sum. Hence it is difficult to select the correct portion of the burden and credit it where credit is due. Over a period of a year such costs total a very large amount and should certainly be included when figuring economies.

Another saving in overhead charges results from the elimination of hand labor. Considered as a nonproductive operation, this type of work is classed as indirect labor and is one of the large items which goes toward making up the total overhead expense. By the elimination of this large item and substituting in its place a relatively small one—"equipment expense"—a large reduction in the total overhead expense is effected.

Decreased supervision, brought about by the installation of equipment that keeps the product on the move, represents another saving in the overhead expense. Materials handled mechanically do not need the supervision that is necessary when the same product is handled with hand labor. Definite routes along which the material is to travel are laid out. By utilizing the force of gravity and mechanical power to the fullest extent this movement is maintained continuously and as such systems are usually definite and unchanging, once they are installed little supervision is necessary.

Management Relieved of Many Details. Management is relieved of many of the details of controlling production by the use of material handling equipment. This is a feature that commends it especially to plant executives. Departments are thoroughly co-ordinated and the entire plant functions to some extent like a large machine. The human factor is eliminated so far as flow of materials is concerned, which enables the management to determine more accurately, and with greater ease, the amount of materials going through the plant.

The more automatic the system the fewer number of labor workers required. Men who are retained in the production departments are mostly machine tenders and have duties that are well defined. Such a state of affairs cuts down supervision and foremanship to a minimum so far as controlling the product through the plant is concerned. Relieved of this duty, foremen can devote their energies toward perfecting production processes and other problems that come before them.

As departments become more closely co-ordinated material flows through the plant with greater uniformity. Uniformity with respect to output is to be desired, as the management may then estimate with a fair degree of accuracy the amount of materials to have on hand. Inventories of material in progress likewise remain balanced, eliminating the delays and troubles caused by underproduction of some products and overproduction of others. A uniform output enables the management to guarantee quick service to customers and also helps in the formation of sales policies.

Clerical and administrative work is also decreased as the material routing is straightened out and the number of stops the product makes cut down. As a path of the product becomes less complicated the less difficult is its control. Clerical work is cut down due to the reduction of both the number of employees and the amount of material in process of manufacture. Costs are also more accurately determined as the human element is eliminated and standard handling methods adopted.

In many plants manufacturing food products the maintaining of sanitary conditions is one of the most important problems of the management. As equipment is introduced which eliminates hand handling, this problem is largely solved. In many cases the products are carried through ovens, evaporators, driers and other processes while on the conveyors. The problem of maintaining sanitary conditions thus becomes largely mechanical.

Improved Quality and Less Spoilage. Another important result from the use of material handling equipment, and one that is frequently overlooked, is the improvement in the quality of output. As conditions for the workers are improved and standardized, the quality of their work is likewise improved. Products handled mechanically receive much better treatment than if handled by hand. There is less breakage while in process of movement and even fragile materials may

be handled with little damage. Foremen, relieved of the responsibility of seeing that materials are brought to the machines at the desired rate for best operation, may devote more time toward improving the product and eliminating waste. The decrease in the time of the product moving through the plant also has its influence on the quality. Parts do not remain in the plant long enough to receive any appreciable wear or deterioration. Many products such as baked foods, heat-treated materials, parts moving through enameling or drying ovens, etc., show an improvement in the quality due to the uniformity of conditions and the ability of mechanical equipment to respond to delicate control. Finally, plants having a thorough handling system are arranged to receive the greatest benefits from their inspection department. As the product has a definite line of movement, inspectors may be easily located at points where inspection is necessary and every precaution taken to see that a high standard of output is maintained.

Decreased Cost of Financing Business. Due to the many benefits of material handling equipment that have already been discussed, the cost of financing a business is materially decreased. Smaller inventories in process of manufacture require less expenditures of capital to maintain the desired production and also decrease the risk of price fluctuation on stock. Rapid movement of material through the plant means a rapid turnover of the money invested in material. Economies in floor space permit carrying on the business in smaller quarters, which results in smaller initial investments or less rent, whichever the case may be. Fewer men are required on the payroll and production costs are reduced to a minimum. In other words, the installation of the proper handling equipment makes a certain amount of capital available to the manufacturer that would otherwise be tied up in the business.

Improved Conditions for Workers. The benefits of material handling equipment are far reaching and effect not only the manufacturer as has been shown, but also the worker and the public as well. For the workers the benefits consist principally of improved working conditions and relief from physical drudgery. In general the position of the worker is bettered as hand labor is given over to mechanical equipment. As more of this type of work is taken over by machinery, greater opportunities are offered the worker to develop skill and get into work that requires brains. With these increased opportunities for development, the morale and interest of the employees increase in like proportions. It naturally follows that as men move up into positions requiring more skill and ingenuity their wages will increase accordingly.

Effect on Public. For the public in general, economies resulting from material handling equipment mean lower prices of commodities. As the volume of production is increased by the application of labor-saving devices, production costs go down, thus permitting the manufacturer to sell his product at a lower price. The net result is that the purchasing power of a dollar is increased and every one is benefited.

The public also benefits by the release of a certain amount of capital due to the proper use of handling equipment. The capital thus released usually finds its way back into industry in the form of factory additions or new plants. New positions of employment are thus created in the building and operating of these plants and the result is that more people receive employment. As the number of industries increases each individual has a greater chance of occupation and a greater possibility of securing employment to his liking.

Computation of Economies Effected. The possible savings may be computed readily by the formulas recently developed by the committee of the Material Handling Division of the A.S.M.E. By means of these formulas the following results may be computed:

a. Maximum investment in dollars that is justified by the given conditiors.
b. Yearly operating cost of the mechanical equipment.
c. The yearly profit to be expected by the use of mechanical equipment.

These formulas have all the necessary factors included and they set down a standard procedure for computing economies.

With standard formulas at hand, there is no longer the possibility of several persons getting wide differences in their results, when figuring on the same problem. Another important feature of the formulas is that they include the item of overhead, which is an economy that has been greatly neglected in the past when computing savings.

These formulas fill a need that has existed for a number of years. There is a growing tendency of manufacturers to demand complete information regarding both the operating costs and economies possible, of a contemplated piece of equipment before they will purchase it. The development of these three standard formulas is a step toward making such information available. All manufacturers of material handling equipment now have a uniform procedure for working out a problem and will know what information regarding their own equipment they must have ready for use.

Hence the importance of thorough analysis cannot be emphasized too strongly. It is by analysis only that many of the inefficiencies are detected. The numerous economies resulting from the proper use of material handling equipment may be realized in all plants, but first these inefficiencies must be located. Finally, when equipment is selected, the measure of the economies resulting from its use should be determined in dollars. With these figures at hand, the selection of the equipment involves little hesitation on the part of the executive.

Conclusion

The economies that may be effected by the installations of material handling equipment may be summarized briefly as follows:

1. Production is increased.
2. Greater speed is obtained in the movement of the product through the plant.
3. Labor expense is reduced.
4. Floor space is economized.
5. Overhead expense is decerased.
6. Management is relieved of many details.
7. The quality of the product is improved.
8. The cost of financing a business is decreased.

These benefits do not merely affect the manufacturer but, as has been shown, are a definite benefit to the public and to the employees. Hence any program that has for its aim the elimination of waste in industry cannot ignore the opportunities offered by material handling equipment.

The "American Process" for Nitrogen Fixation

Direct Synthetic Process Developed at Fixed Nitrogen Research Laboratory Exhibited

RECENT visitors at the Fixed Nitrogen Research Laboratory, Washington, have been much impressed by the new developments of that laboratory typified in the small direct synthetic ammonia plant now being operated with a capacity of about ¼ ton per 24-hour day. This plant, shown diagrammatically herewith, is based upon the results of 5 years research of the government specialists. It has already demonstrated that certain of the new principles which they propose can be operated successfully, at least upon a semi-commercial scale. Larger-scale operation promises equal success.

Maintenance of Gas Purity

A large item of cost in a direct synthetic ammonia plant is the production and purification of hydrogen. Very high-purity gas is needed if highly reactive catalysts are to be employed efficiently, since otherwise the catalyst is poisoned. Because the cost of relatively complete gas purification has seemed high, many have argued that highly reactive catalysts could not be employed advantageously in commercial practice. However, A. T. Larson and F. A. Ernst, under whose direction these improvements have been developed, have met this objection in a very ingenious fashion. In this process two catalyst chambers are employed, the first containing a rugged but relatively inefficient catalyst followed by an ammonia condenser, intended to purify the gas, and the second containing a catalyst of high reactivity, which operates successfully at high efficiency for long periods upon properly purified nitrogen-hydrogen mixtures.

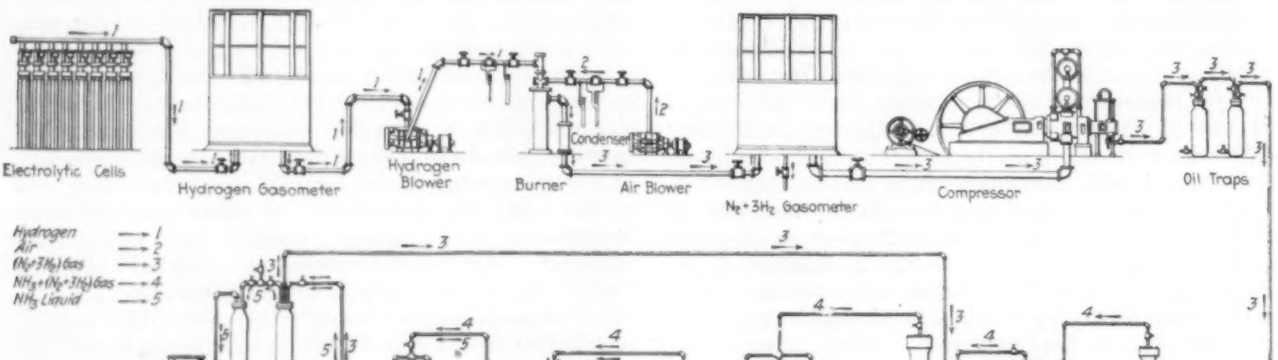
Purifier Pays Own Way

The use of this system of purification not only is successful in eliminating the impurities of the gas but it also does this at practically no cost, since the ammonia formed in this bomb has sufficient value to pay for the cost of operating the purifying system. This making the purifier pay its own way is certainly a tremendous advance.

Once the gas is obtained in pure form, it is important to keep it so, lest on recirculation it damage the catalyst. To accomplish this result the second important advance in the process has been made at the laboratory. This is the use of a circulating pump lubricated with liquid ammonia. Elimination of lubricating oil at this point effectively prevents contamination of the purified gas after leaving the main converter. Hence after condensing the liquid ammonia completely, the remaining hydrogen-nitrogen mixture can safely be recirculated to the converter as many times as necessary. Thus there has been worked out in actual practice the important principle of "get the gas clean and then keep it so."

General Character of the Process

As shown in the diagram, the process is essentially similar to other direct synthetic methods, in that it employs recirculation. The diagram shows the system using electrolytic hydrogen. The hydrogen supply is forced by a blower through a burner, where it reacts with an amount of air so limited as to produce only nitrogen, hydrogen and water in the products of combustion. The excess of hydrogen is so proportioned that the mixture is just one nitrogen to three hydrogen.



Direct Synthetic Ammonia Process

From the mixed gas storage a compressor drives the gas through oil traps, one of which is empty and one of which is filled with charcoal to remove all oil vapor, and then through the purifier or first catalyst chamber.

Some of the ammonia formed in this first bomb is condensed and separated from the remaining gas. The water and other products of reaction are carried out of the system as impurities in this liquid ammonia. The remaining gas, thus purified, passes to the main converter, then into the condensers, where some liquid ammonia is formed, through the circulating pump, which is sealed with liquid ammonia, and then through the final condensers. The liquid ammonia is removed in the high-pressure ammonia receivers and the remaining gas, which is still pure, returns to the inlet of the converter.

The laboratory has for some time been working on detailed engineering plans for application of this system on the scale of several tons of ammonia per day. Already several arrangements for such application have been tentatively made.

Further application on a still larger scale will undoubtedly follow in the not distant future.

A Paradox in Corrosion

The Mechanism by Which Currents Are Produced Explains Why Corrosion Depending on Oxygen Is Sometimes Greatest Where Oxygen Is Excluded

By Ulick R. Evans
Author of "Metals and Metallic Compounds"

IT has been previously demonstrated that the corrosion of metals such as zinc, cadmium, iron and lead is electrochemical in character. (See U. R. Evans, *J. Inst. Met.*, 1923, vol. 30, p. 239. Compare J. Aston, *Trans.* Amer. Electrochem. Soc., 1916, vol. 29, p. 449.) If a piece of commercial metal immersed in a salt solution is exposed to dissolved oxygen over certain parts of its surface and is protected from oxygen over other parts, it can be shown that an electric current flows between the aërated and unaërated areas; the current is maintained by the eating away of the metal upon the unaërated area, which constitutes the anode of the cell, while the aërated part becomes cathodic and in general suffers very little attack. It is possible, in fact, to generate a current from a divided cell in which both electrodes consist of iron immersed in a $N/2$ potassium chloride solution, the only difference between the two electrodes being that air is bubbled over the one while the other is protected from oxygen by means of the porous partition; if the iron electrodes are weighed before and after the generation of current, it will be found that the loss of weight of the unaërated electrode only slightly exceeds that which would (according to Faraday's law) be required to produce the current actually obtained. If the resistance of the whole circuit has been small, the aërated electrode will be found to have lost much less weight than the unaërated electrode.

> Previous experiments have shown the surprising fact that in certain cases where oxygen is needed to allow corrosive action to proceed the corrosion is most intense at just those parts of the surface which are protected from the direct access of oxygen. The mechanism of this apparent paradox is described in this article.

This experiment can be used to explain various phenomena that are observed when metals are exposed to a saline solution under conditions of "differential aëration." If, for instance, a zinc plate is partly immersed in a solution of potassium chloride, the portion just below the waterline is scarcely attacked, but the more deeply immersed portion is distinctly corroded; at the junction of the uncorroded and corroded areas there is a sinuous wall of membranous zinc hydroxide, often extending several millimeters outward from the metallic surface. The explanation is that a current has passed between the aërated area above and the unaërated area below; at the aërated (cathodic) area, alkali is produced, while at the anodic portions below, zinc chloride is formed; the membranous wall of zinc hydroxide appears along the surface where the potassium hydroxide and the zinc chloride meet.

Again, if a drop of potassium chloride solution is placed on a horizontal iron surface, alkali is produced around the margin of the drop, where oxygen can reach the iron, and ferrous chloride in the central portion. (See U. R. Evans, *J. Oil & Colour Chemists Assn.*, 1923, p. 149.) A ring of white ferrous hydroxide is precipitated at the point where they meet and this gradually darkens owing to oxidation, and finally a flabby membrane of brown ferric hydroxide extends right over the drop. Outside the membrane there is a clear ring of alkaline liquid, and the iron, being cathodic, is not attacked; on the other hand, if the membranous hydroxide is wiped away it will be seen that the iron in the central (anodic) portions has been very distinctly corroded.

These and many similar experiments have served to give an explanation of one of the most startling facts of corrosion — namely, that (under conditions where oxygen is actually needed to allow the corrosive action to proceed) the corrosion is most intense at just those parts of the surface which are protected from the direct access of oxygen. It is well known how marked local corrosion tends to occur over areas covered up by porous debris or even by porous corrosion products, and it is even more significant how corrosion tends to become concentrated at the bottom of a few narrow crannies, where the corrosive agency seems to burrow into the metal until the article is perforated. This concentration of corrosion upon inaccessible points can be explained only on the electrochemical view of corrosion.

There remains one important matter to be decided regarding the mechanism by which the currents are produced. Two different mechanisms are possible:

First Possible Mechanism—Oxygen is taken up over the whole of the aërated area, producing a thin, adherent layer of oxide; this alters the potential in the noble direction, producing partial passivity, in the manner suggested in previous papers. (See U. R. Evans, *Trans.* Faraday Soc., 1922, vol. 18, p. 1. See also a paper by U. R. Evans, "On the Influence of Obstructive Films on Anodic Processes," to be published in the *Transactions* of the Faraday Society for 1924.) The whole aërated area thus becomes the cathode, and the unaërated (active) area the anode.

Second Possible Mechanism—Where the metal has a duplex structure (containing spots of a comparatively "noble" character) or where it is in contact with a second nobler metal, the noble spots of the aërated area (or the contact material) may constitute the true cathodes of the cell. By the term "duplex structure" it is intended to include not merely cases in which a second metal is present as a separate phase (either in the intergranular eutectic or as separate particles) but also cases where physical uniformity is

lacking; an example of this kind is afforded by partly annealed metals in which the old grains, shattered or deformed by previous mechanical working, are present in some places, while new, stable, undeformed grains have been formed by recrystallization in other parts of the material; these undeformed grains would be the ones likely to assume a cathodic function. In my last paper, I have been inclined to accept this second mechanism as being the more probable. (U. R. Evans, *J. Inst. Met.*, 1923, vol. 30, p. 239.)

If the first mechanism operates alone, then differential aëration should produce a current, whether the metal has a duplex structure or not; the second mechanism requires the presence of a duplex structure. The question is, therefore, one of great practical importance. If the second mechanism alone is effective, we may hope to obtain a nearly non-corroding material by obtaining a metal in a state of great purity and physical uniformity; if the first mechanism is effective, attempts in this direction are futile. (Of course in the type of corrosion—e.g. by acids—which leads to the evolution of hydrogen in gaseous form, it is undisputable that the presence of impurities increases the rate of attack.) There is no reason, of course, why both mechanisms should not be operative under suitable conditions.

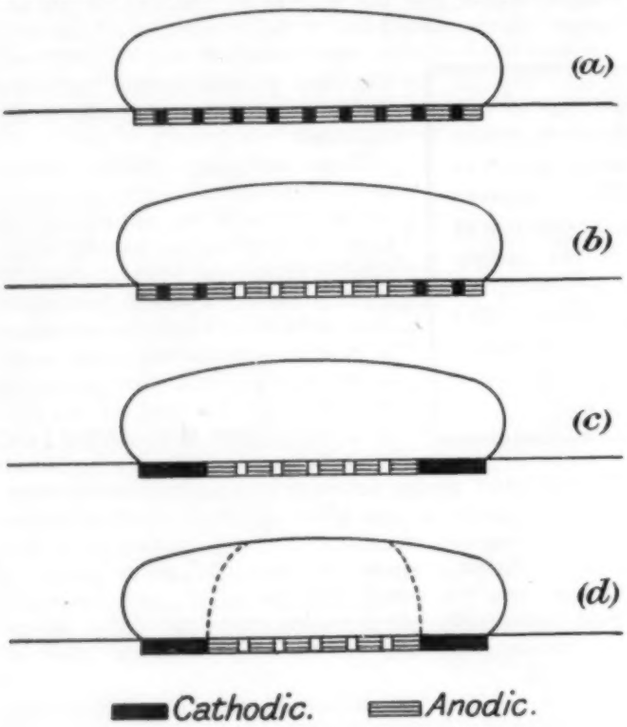


Fig. 1—Corrosion of Iron
What happens in a drop of salt water according to the "second mechanism."

The Two Mechanisms Not Easily Distinguishable

It is not so easy to distinguish between the two mechanisms as one might suppose. At first sight it might appear that the two mechanisms should lead to quite different results, since in the second case only a small fraction of the aërated portion should be cathodic. In the opening stage of the corrosion process this is no doubt true, but in the later stages further changes may be produced. Let us consider once more the experiment of placing drops of potassium chloride solution on an iron surface, and assume for a moment that the second mechanism alone operates. At first the foreign particles over the whole area covered by the drop will act as cathodes, the rest of the iron constituting the anode. (Fig. 1 *a*.) But in the interior of the drop the oxygen supply will soon run out and the foreign particles here will cease to act cathodically. We are left with the foreign particles around the margin acting cathodically toward the iron over the whole wetted area. (Fig. 1 *b*.) In the interior of the drop, where practically no alkali can penetrate, the anodic product will be ferrous chloride, which, being soluble, will not interfere with the continued dissolution of the metal. In the outer annulus, however, the alkali formed over the cathodic particles will spread over the iron around them, and here the principal anodic product will be a thin and invisible film of iron hydroxide; in other words, the iron in this outer portion will become passive and cease to pass into solution. When the iron has become so completely passive that dissolution stops in the outer annulus, it follows that the potential of the protected iron will be equal to that of the foreign particles. When, therefore, this "equi-potential condition" has been set up over the whole of the outer ring, the whole of this outer area will function as cathode, while the interior portion, to which no alkali can penetrate, will continue to act as anode. (Fig. 1 *c*.) The membranous precipitate of iron hydroxide which will be produced where the alkali and the iron salt meet (Fig. 1 *d*) will further aid in preventing the diffusion of oxygen or of alkali into the interior portion, and will thus allow the anodic attack of the iron in those parts to proceed unhindered.

We thus see that the second mechanism, just as well as the first, would lead to the result which is actually observed in practice. It is quite consistent with the fact that the attack of iron by a neutral or nearly neutral solution is practically independent of the amount of foreign particles present, since after a very short time we have the whole of the aërated area acting as cathode toward the unaërated area as anode. Of course, if foreign particles were completely absent, this state of affairs would never be set up, and we should expect to get no corrosion, unless the first mechanism comes into play.

Special Experiments Undertaken

The foregoing considerations indicate that the second mechanism is as capable of giving a rational explanation of the known facts of corrosion as the first mechanism. It seemed therefore necessary to carry out special experiments to ascertain which of the two mechanisms was operative. Accordingly a differential-aëration cell was set up in which it was possible to compare the amount of current produced by simple electrodes with that produced by an electrode system of a duplex character. The cell was divided into two compartments, each containing a strip of some reactive metal, such as cadmium. By bubbling air through one compartment the current produced could be measured; this was termed the "simplex arrangement." Then by operating a switch it was possible to bring a copper electrode in each compartment into electrical contact with the reactive metal; this gave the "duplex arrangement," and the current under the new conditions could be measured. The choice of copper as a suitable contact material was suggested by the fact that if copper electrodes alone receive differential aëration,

no current is produced in the normal direction. A small current indeed is produced in the opposite direction, the copper strip over which air is passed becoming not positive (as is usual), but negative; this effect is due to the stirring effect of the bubbles, which reduces the copper-ion concentration in the compartment through which bubbles are passed, and thus leads to the production of a concentration cell; it has been studied in some detail in a previous paper. (*J. Inst. Metals*, 1923, vol. 30, p. 239.) We shall denote the currents in the two directions as "aëration currents" and "stirring currents" respectively.

In one experiment, silver was used in the place of copper as the contact material.

There was no object in using metals of an extraordinary degree of purity, because in any case if a reactive metal is immersed in a solution along with a copper electrode, there is always a danger of the deposition of a trace of copper on it. Analysis of the metals employed gave the following results: The lead contained 0.005 per cent of copper, 0.006 per cent of iron, 0.002 per cent of arsenic and a trace of zinc. The cadmium contained 0.08 per cent of iron and 0.07 per cent of lead. The iron was "Armco" and contained more than 99.84 per cent of iron. The zinc, although purchased as "pure zinc foil," was found on analysis to contain as much as 0.95 per cent of lead and 0.017 per cent of iron. (Some subsidiary experiments were performed afterward with electrolytic zinc, and confirmed qualitatively the results of the main research.) The copper was electrolytic. The silver was of a high degree of purity and contained only traces of copper. The electrodes were rubbed with emery before use; acid pickling, which would charge the metals with hydrogen, was avoided.

Description of Apparatus Employed in the Experiments

The connections of the apparatus employed are shown in Fig. 2, and the cell is shown in elevation in Fig. 3. The outer vessel, *B*, consisted of a beaker 7 cm. in diameter and 11.5 cm. high. The porous pot *P*, which was 4.5 cm. in diameter and 12.5 cm. high, was fixed centrally in the beaker by specially cut corks. The electrodes R_1, R_2, N_1, N_2 were clamped by brass terminals on to glass rods which passed over the top of the beaker or porous pot. Slotted sheets of mica, M_1 and M_2, prevented the brass terminals from being splashed. A current of air, freed from carbon dioxide and ammonia and finally washed with water, was supplied to the apparatus; a three-way tap, *T*, allowed it to be bubbled at will either through the inner compartment or through the outer compartment. The switch system was such that by closing the double pole switch, S_1, the reactive metals R_1 and R_2 alone were put into connection with the milliammeter, giving the so-called simplex arrangement, while by closing the switch S_2 the noble electrodes, N_1 and N_2 (either copper or silver), were also joined to the milliammeter, giving the duplex arrangement. A reversing switch S_3 was provided in order that, whichever way the current was sent out from the cell, it always passed through the milliammeter in the appropriate direction.

Various experiments were carried out with three different "reactive metals" (zinc, cadmium and lead), two different noble contact materials (copper and silver), and various solutions (consisting of potassium chloride, either alone, or with acetic acid, boric acid, sulphuric acid or sodium hydroxide).

The immersed areas of the electrodes in general measured 4.8x1.6 cm., but in the case of zinc, which tended to give an inconveniently large current, it was 4.8x1.1 cm.

By altering the tap and switches, four different conditions are possible—namely:

	Abbreviated Description
(1) Simplex connection, with bubbling through inner compartment	*(SI)*
(2) Duplex connection, with bubbling through inner compartment	*(DI)*
(3) Simplex connection, with bubbling through outer compartment	*(SO)*
(4) Duplex connection, with bubbling through outer compartment	*(DO)*

The procedure was to take readings of the current produced under all four conditions at different stages of the process. For instance, one might start with duplex, bubbling air through the inner compartment, and take readings of the current every quarter-minute. When the reading was fairly constant, it would be recorded as the current under the *DI* condition at this

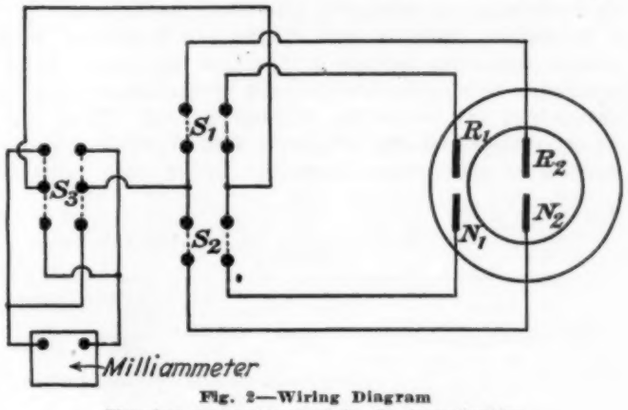


Fig. 2—Wiring Diagram
Showing apparatus used in the investigation

particular stage of the experiment. One would then alter the tap so as to pass bubbles through the outer compartment, and obtain the current with the *DO* arrangement. As a rule about 2 minutes was needed to obtain fairly constant readings on the milliammeter, although in the early stages of the experiment much longer periods were required in some cases. The experiments were usually continued for about an hour. The values of the currents obtained are recorded in the accompanying table. It will be noticed that the value obtained for any one condition varied considerably. Sometimes there was a progressive alteration throughout the experiment; this was most often obtained with the simplex arrangement, the value recorded tending to approach the duplex value as the experiment proceeded. More often the value obtained on establishing any particular condition depended on what condition had been established previously. Furthermore, it will be noticed that (in both the simplex and the duplex arrangement) the value obtained when air is bubbled through the outer compartment is different from that obtained when it is bubbled through the inner compartment. This lack of symmetry may be explained on the assumption that the foreign particles were not uniformly distributed throughout the sheets from which the electrodes were cut, and that the different behavior of the two electrodes

in a given cell is due to the fact that one of them happens to have exposed a greater area of foreign impurities. It may, however, be due rather to non-uniform distribution of gases, or possibly to lack of physical uniformity, throughout the sheet.

After due allowance has been made for all irregularities, one clear fact emerges from the figures—namely, that the aëration current produced by the duplex arrangement is much greater than the current produced under corresponding conditions with the simplex arrangement. Indeed, the simplex arrangement in many cases, especially at the commencement of the experiments, produces no "aëration current" at all. There is merely a small "stirring current" in the abnormal direction (indicated by the minus sign before the figures in the table); of course, this "stirring current" can be detected only when the "aëration effect" is absent. In general, the "stirring current" in the abnormal direction is only temporary and gives way to a small "aëration current" in the normal direction. Where the electrolyte used is a neutral potassium chloride solution, there is a progressive tendency for the simplex reading to rise during the experiment, and this is most simply explained by assuming the formation of a film of oxide or hydroxide, according to the "first mechanism."

A similar effect is seen in the cell furnished with a bath containing boracic acid, where the simpler reading tends to rise toward the end of the experiment to values not far below the duplex reading. This may be attributed to a film of lead borate appearing on the surface of the aërated electrode, to which it imparts cathodic functions. On the other hand, in cells containing acetic acid, which would prevent the formation of a protective film, a very different state of affairs is obtained; with lead, indeed, there is no measurable "aëration current" produced with the simplex arrangement throughout the whole experiment, although a very marked current is seen when the switch S_1 is pushed into the duplex position. With cadmium, the initial small "stirring current" in the abnormal direction gradually passes into a small "aëration current" in the normal direction; but even at the end of the experiment, the simplex reading is very small compared with the duplex reading. The behavior of zinc in a solution containing acetic acid furnishes an especially interesting case, because the metal is capable of displacing hydrogen in gaseous form from the solution used. Notwithstanding this fact, the cell shows the aëration effect well, and shows quite a large current in the simplex arrangement, although contact with copper causes a considerable increase.

A consideration of the facts just stated suggests that both mechanisms can play a part in producing a current. The production of a current in the simplex arrangement is most simply explained by the first mechanism; but the great increase in the current when a noble material is brought into contact indicates that the second mechanism is brought into play. The fact that a current can be set up by differential aëration

Values of Currents Obtained in the Cell Under Various Conditions

		Cell (Metal in Parentheses Used in "Duplex Arrangement")			Bubbling Through Inner Compartment		Bubbling Through Outer Compartment	
					Simplex (*SI*)	Duplex (*DI*)	Simplex (*SO*)	Duplex (*DO*)
Copper Contact Material	Neutral Baths	Zn (Cu)	*N*/10 KCl	Zn (Cu)	Milliamp. +0.08 to 0.2	Milliamp. +0.4 to 0.6	Milliamp. +0.18 to 0.48	Milliamp. +2.0 to 2.6
		Cd (Cu)	*N*/10 KCl	Cd (Cu)	—0.18 at first quickly changing to values between +0.06 to 0.12	+0.5 to 0.6	—0.1 to +0.1	+0.22 to 0.28
		Pb (Cu)	*N*/10 KCl	Pb (Cu)	—0.12 to +0.04	+0.16 to +0.52	+0.20 to +0.28	+0.32 to +0.72
	Acid Baths	Zn (Cu)	*N*/10 KCl + *N*/10 HAc	Zn (Cu)	+0.04 to +0.32	+0.12 to +0.68	+0.40 to +0.52	+1.8 to 2.2
		Cd (Cu)	*N*/10 KCl + *N*/10 HAc	Cd (Cu)	—0.04 to +0.08	+0.56 to +0.64	—0.12 changing to +0.12	+0.64 to +0.76
		Pb (Cu)	*N*/10 KCl + *N*/10 HAc	Pb (Cu)	—0.04 to —0.12	+0.52 to +0.56	—0.2 to —0.12	+0.56 to +0.64
		Pb (Cu)	*N*/10 KCl + *N*/10 H_3BO_3	Pb (Cu)	+0.12 to +0.36	+0.24 to +0.36	—0.18 changing to +0.48	+0.56 to +0.72
	Alkaline Baths	Pb (Cu)	*N*/10 KCl + *N*/10 NaOH	Pb (Cu)	—0.12 to +0.28	—0.32 changing to +0.40	—0.16 changing to +0.40	+0.52 to +0.68
Silver Contact Material		Pb (Ag)	*N*/10 KCl	Pb (Ag)	+0.04 to +0.08	+0.40 to +0.44	—0.08 to —0.12	+0.60 sinking to +0.32

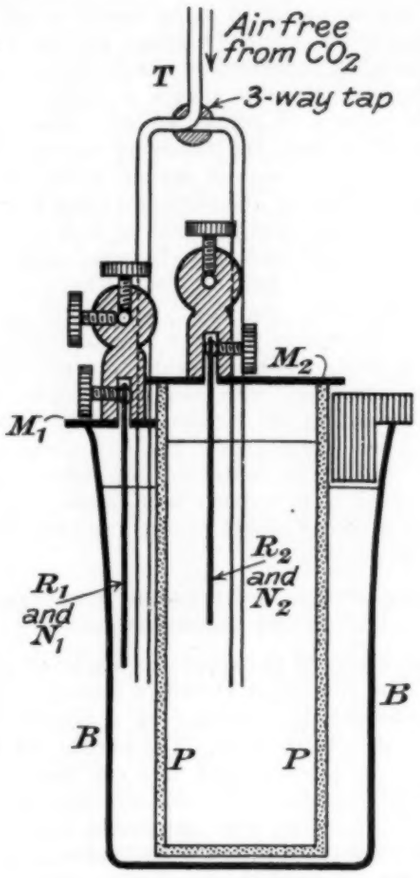


Fig. 3—The Cell
Apparatus used for comparing the amounts of current produced when electrodes of different types were immersed in various solutions

in an acetic acid solution, wherein an oxide layer could scarcely be formed, can be explained only on the second mechanism.

In a recent communication (*J. Inst. Metals*, 1923, vol. 30, p. 293) Bengough and Stuart seek to explain the production of current on the supposition that "the scale acts as an electrode." In the experiments just described there was no "scale" in the ordinary sense of the word on any of the specimens used, since they were cleaned with emery just before introduction. If the authors use the word "scale" to denote the thin layer which actually causes the protection or ennoblement, their view is practically identical with that described above as the "first mechanism," although their method of stating it is somewhat unfortunate. It is, however, always difficult to know exactly what these investigators mean by "scale." Bengough and Stuart use the word "scale" to include every form of corrosion product, whether formed through direct oxidation, through direct anodic attack, or through precipitation of the anodic products by the cathodic products. (*J. Inst. Metals*, 1922, vol. 28, p. 40). The visible "blanket" of corrosion deposits formed on metals often has the last-mentioned origin, the directly formed layer, which is much more effective as a protective covering, being probably in many cases invisible. Whatever their meaning, Bengough and Stuart's mechanism cannot account for all cases of the production of current by differential aëration, since current can be generated in acetic acid solutions wherein the formation of "scale" of any sort is very unlikely.

SUMMARY

Former papers have shown that the corrosion of metals in chloride solutions in the presence of oxygen is electrochemical in character, being connected with electric currents flowing between the aërated and unaërated parts of the surface; the unaërated (inaccessible) places become anodic, and attack becomes concentrated at these points, thus producing pitting or deep local corrosion. The present paper discusses the mechanism of the production of these currents. They might be due to one of two mechanisms:

(1) The whole aërated area is ennobled by a thin protective film, so that the whole aërated area acts as cathode.

(2) The "nobler" particles of the aërated area alone act as cathodes in the first instance.

Both mechanisms explain adequately most of the known facts of corrosion, but in view of the bearing of the question as to whether a perfectly pure, uniform metal (if obtainable) would be non-corroding, it seemed important to decide between them. It was found by experiment that when two electrodes of the same material (zinc, cadmium or lead) were placed in a divided cell, a current was set up when one electrode (only) was aërated, provided that the solution was one that allowed the production of an insoluble film over the aërated surface; this supports the first mechanism. In a solution of potassium chloride containing acetic acid (where no oxide-film could be produced by aëration), little or no aëration current was obtained with pure lead or cadmium, unless the electrodes in each compartment were joined to a nobler material, copper; contact with copper greatly increased the current even where it could be produced in the absence of such contact. This indicates the second mechanism, and it is concluded that current can be produced in both ways.

Anhydrite Investigation Planned

The non-metallics station of the U. S. Bureau of Mines at New Brunswick, N. J., is contemplating a study of the utilization of anhydrite. One of the problems to be investigated is the utilization of anhydrite as a retarder in cement in place of gypsum. It is now widely believed that anhydrite is unsuitable for this purpose, but convincing evidence is lacking and the bureau proposes to determine whether this belief is based upon a sound scientific foundation. In working out gypsum deposits, it is generally found that the percentage of anhydrite in the gypsum increases with the depth of mine. This materially shortens the life of a property and, of course, increases operating costs materially. It is, therefore, proposed to determine whether there are not practicable commercial methods for hydration of anhydrite to form either gypsum ($CaSO_4.2H_2O$) or plaster of paris ($CaSO_4.\frac{1}{2}H_2O$) from the anhydrite ($CaSO_4$). Work on this problem is only now being considered, so that it will be some time before the bureau has any conclusions for publication.

Zinc Roofs Under Test

Tests of corrugated zinc roofing are now under way at the Bureau of Standards for the purpose of determining the loads that can safely be carried by this material. Unlike most roofing materials, zinc fails not by breaking but by bending slowly under load, the material taking a permanent set. It is therefore not considered desirable where heavy loads must be borne continuously, unless it is well supported. But where the normal load is light, as it is apt to be in the tropics, zinc roofing may prove more durable than galvanized steel, as the latter fails rapidly from corrosion in such climates.

The test made on the roofing consists in loading the corrugated sheet with sand, the sheet being supported on a framework representing the roof purlins. The load is left in place for a month or more and the deflection is measured each day.

Would Improve Flint Grinding

The grinding of flint for ceramic uses is a quite difficult problem on account of its great toughness and resistance to abrasion. Heating the material before grinding makes the process easier. Interior Department investigators at the New Brunswick, N. J., experiment station of the Bureau of Mines will make experiments to test the efficacy of combined heating and quenching. The method may be extended to other minerals.

To Study Flint Fireclay Expansion

The purpose of an investigation being made by Department of the Interior technologists at the Columbus, Ohio, experiment station of the Bureau of Mines is to ascertain as definitely as possible what causes flint fireclay to change its volume during the process of heat-treatment. Results to date indicate that the Missouri flint clays have a much greater shrinkage than the Pennsylvania flint clays. A comparison of the burley flint and smooth flint clays taken from the same locations shows that the smooth flint clays shrink to a greater degree. The difference in shrinkage is attributed to the diaspore in the burley clays, which acts like a grog.

Equipment News

From Maker and User

Motor vs. Engine in Driving Centrifugals

By Robert Hudson
Secretary, Valkone Dyeing & Finishing Works, Philadelphia, Pa.

We have used centrifugal extractors in our plant for many years. These machines must be in good working order and capable of continuous operation, because a delay in extracting holds up production all along the line. For this reason we have taken great care with our extractor equipment.

We now have two 60-in. Fletcher motor-driven extractors and one 60-in. engine-driven extractor of the same make. Since installing the two motor-driven machines we have been able to discard three engine-driven units. Operation for the machines we now have is continuous over a 9-hour day, and often for longer periods. The batch dried averages about 250 lb. and consists of flannels, blankets and similar goods. With the motor-driven machine about 4 minutes running time is required to dry the batch and it takes about 30 seconds or less to get up to full speed. One machine, operated by one man, handles thirty-six batches, or 9,000 lb., of goods per 9-hour day.

The operating cost of these machines is low. The depreciation is also low. The fixed cost, including depreciation, interest and repairs and maintenance, is only $0.76 per working day. The total cost of operation, including fixed cost, labor and power, amounts to $7.19 per day. The cost per 1,000 lb. material handled is $0.799, which is reasonable for this class of work.

The engine drive requires a comparatively large amount of attention. There are many more moving parts and the vibration is a decided disadvantage. The engine-driven extractor is not as simple and foolproof as the motor-driven machine. Care is required in starting up the engine and more time is needed to attain full speed—3 or 4 minutes as compared to 30 seconds for the motor. Because of this difference, the motor-driven centrifugals handle seven more batches per day than did the engine-driven type.

Fig. 2—End View of Still Car, Showing Dutch Oven Construction

In spite of the fact that it does about 19 per cent less work, the engine-driven machine costs more to operate. Depreciation is more than twice as much, because of its shorter life; and repairs and maintenance are about six times as great, averaging $90 per year per unit instead of $15. Power is more expensive, because the small steam engine has a high water rate. The total daily cost of the engine-driven extractor is $9.45, which is $2.26 more than the daily cost of the motor-driven unit. Since the capacity is only 7,250 lb. per day as against 9,000 lb., the cost per 1,000 lb. is $1.303.

The motor-driven machine costs only $0.799 per 1,000 lb., which is a 39 per cent reduction in cost. The saving of $0.504 per 1,000 lb. amounts to $4.536 per day, or $1,383.48 per year, for each machine. The annual saving on the two machines is $2,766.96, a return of 46 per cent on the investment. In other words, the two machines repay their entire original cost in about 2 years.

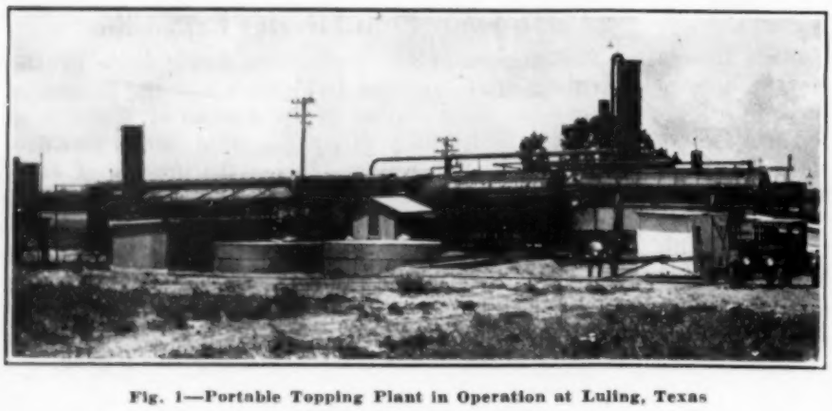


Fig. 1—Portable Topping Plant in Operation at Luling, Texas

An Oil Refinery on Wheels

New Topping Plant Includes Several Unusual Features in Addition to Its Portability

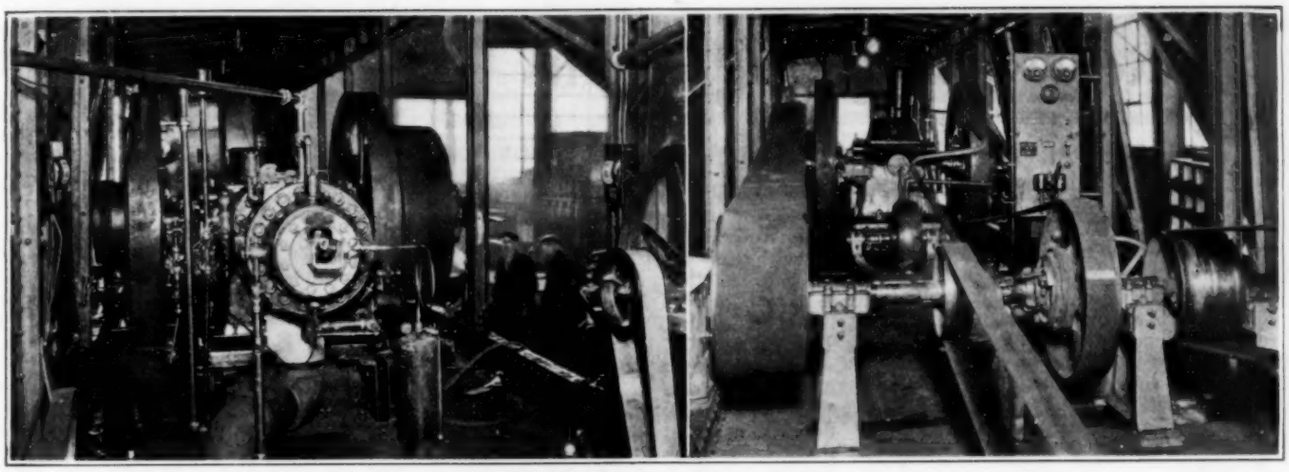
Several new departures in crude oil refining are to be observed in a portable topping plant, recently put in operation at Luling, Caldwell County, Texas. Condensation of vapors is effected by air cooling instead of by water, a 70-in. suction fan circulating air through the condenser coils. The same cooling also fractionates the heavy vapors in the rectifying tower.

The still is of a type commonly employed in the distillation of tar, making it possible to bring the still up to temperature much more quickly than is the case with an ordinary shell still. The Dutch type oven at the front of the still is equipped with two fuel oil burners. Extending longitudinally through the center of the still are two 24-in. hammer welded, seamless flues. Forced air draft from the suction fan forces the flame and hot gases through these flues, thus carrying the heat through the fluid in the still. After passing through these flues, the gases are returned along the sides of the still through air-tight, heat-retaining compartments, formed by firebrick walls. After passing through these compartments at the sides of the still, the heated gases are sent through another compartment, immediately under the still, formed by fin walls, and finally emerge from this latter compartment into the stack. Thus the heat goes through the fluid by means of the flues and in addition is brought into contact with more than one-half the outer surface of the still in passing through the airtight passageways.

F. Puening, chief distillation engineer of the Koppers Co., of Pittsburgh, Pa., is the designer of the still, the entire refinery having been built by the Graver Corporation in its plant at East Chicago, Ind.

The refinery is electrically operated throughout, the use of steam being entirely eliminated. A 70-hp. Bessemer oil engine drives the electrical generator of 14.4 kw., alternating current, 220 volts, three-phase, sixty cycles.

Probably the outstanding feature of the refinery as a new contribution to the industry is found in its portability. The main equipment of the plant is permanently attached to and operated from two steel railway cars. With the exception of certain detachable equipment, such as the rectifying tower, smoke stack, pumps and pipe connections, the plant can be moved intact on these big railway cars and with virtually no loss in salvage. After the cars carrying the refinery are spotted at the point of operation, the plant can be put to work within 8 or 10 days.



Figs. 3 and 4—Two Views of Interior of the Portable Power Plant

Four or 5 days is required to dismantle detachable equipment and place it in transit again.

These heavy railway cars carrying the refinery do not rest on their wheels while the plant is in operation. Instead they are jacked up on being spotted and lowered on concrete foundation supports, built crosswise the tracks. On being lowered on these supports the cars are tied down to the tracks with heavy steel rods, thus being steadied while the plant is in operation and removing the heavy weight from the car wheels.

The refinery has a capacity ranging from 1,000 to 3,500 bbl. of crude in 24 hours, dependent upon the completeness of distillation. Distilling off 60 per cent of the crude, the refinery can handle 1,000 bbl. in 24 hours in four 6-hour runs.

The railway cars on which the equipment of the plant is carried are 65 and 70 ft. long. The longer car carries the power equipment, including the engine, electric generator, suction fan, air compressor for starting power for the engine and a 2-hp. gas engine to operate this compressor, air tank, radiator for cooling water to cool the engine, low-pressure blower to atomize fuel for the burners, electric switchboard and other power equipment. The still car carries the still, heat exchanger and condenser.

The refinery was built for the Portable Refinery Co, of Dallas, Tex. The idea of portability for the plant was conceived by T. W. Sowell, of Dallas, president of the Portable Refinery Co., which owns the plant. The refinery was placed in operation at Luling during the early part of April.

Eliminating "Hot-Spots"

In many different industries there are certain jobs having a particularly high labor turnover due to the hot, disagreeable conditions attendant. To provide a means of local ventilation that will eliminate the unpleasant features of such work and hence give less turnover and higher quality and quantity of output, the American Blower Co., Detroit, Mich., has recently placed on the market its new model of "Ventura Man-Cooling" Fan.

This fan is like a larger edition of the familiar desk fan. It stands on a sturdy base at such a height as to place the air current where needed. Two sizes of this new model are made, wheels 21¼ in. and 37¼ in. in diameter, operating at 1,725 and 1,120 r.p.m., and requiring 1 and 4 hp. respectively.

Oil Extraction System

Solvent extraction of oil-bearing seeds is generally regarded as an inevitable development, particularly in view of increasing necessity for conserving oleaginous materials. At the New Orleans convention of the American Oil Chemists Society, L. C. Whiton described the oil extraction system developed by Edouard Bataille, of New York City, for the recovery of oil from spent fullers earth.

The Bataille oil extraction system has been in a process of evolution since 1896, when the first extractor was built for extracting the perfume from violets in the south of France. As it is today, it might be described as a Soxlet extractor built upon a commercial scale. This means that methods have been devised to dispose of agitators as well as circulating pumps. For some years past there has been considerable interest in the successful and complete extraction of fullers earth by the solvent method. In theory this was always easy of accomplishment. In practice it required an automatic working machine, preferably offering no fire risk and with a minimum labor charge.

A self-contained apparatus possessing all of the necessary steel structural work, so that it can be conveniently placed upon the floor of an ordinary refinery without special foundations, and which requires no other installation cost than the connection of steam, water and waste piping, has been recently developed. The installation consists of a combined extractor and still, a combined condenser and solvent tank, a steam drier and a solvent recovery tower with its special still.

For small installations it is more economical to use a more expensive nonflammable solvent than, for example, gasoline or benzol. That which is most indicated is trichlorethylene, since carbon tetrachloride hydrolizes, forming hydrochloric acid, which destroys metal apparatus of this sort. Although this solvent costs three times as much as gasoline, the low percentage of loss prevents it from being an important factor in the cost of operation and the advantage gained by being able to place the extractor in an existing building where it can be operated by the same operator that is now used for other machines repays several times the increased cost of solvent.

Watt-Hour Meter

A new service type of direct-current watt-hour meter, type C-15, has been placed on the market. This meter is much smaller and lighter in weight than the present type, C-6. In addition to its reduced size and weight, other outstanding features are a thin cast alloy back or base; bottom connections with separate terminal compartment and removable terminals, and the same damping magnets and register as used on standard service type alternating-current meters, together with armature and shunt field coil similar to those used with the type C-6.

The new meter has been developed in 5- and 10-ampere, two- and three-wire ratings. Its over-all dimensions are 11⅝x5⅞x5⅞ in., with a weight of 6 lb., 6½ oz. It is made by the General Electric Co.

Manufacturers' Latest Publications

A. P. Green Fire Brick Co., Mexico, Mo.—A booklet on the use of "Quick-Pach," a plastic fireclay for making monolithic linings and quick repairs.

Breeze Metal Hose & Mfg. Co., 250 South St., Newark, N. J.—A folder on "Fle-X-Met," flexible metallic hose of industrial uses.

Tirrill Gas Machine Lighting Co., 50 Church St., New York—A folder on a machine that makes fuel gas from gasoline for various heating purposes.

Wellman-Seaver-Morgan Co., Cleveland, O.—Bulletin 82. A catalog of the Type L No. 8, gas producer, which is an improved design of the Hughes type mechanical producer.

Steere Engineering Co., Detroit, Mich.—Pamphlet 266. A leaflet describing steel purifier boxes for use in gas works.

Illinois Zinc Co., Peru, Ill.—A folder describing the use of corrugated zinc sheet in industrial construction work.

Weston Electrical Instrument Co., Newark, N. J.—A 100-page book entitled "Electrical Testing in Industry," written with the purpose of instructing plant engineers in methods of using Weston instruments in testing the electrical equipment which is under their care.

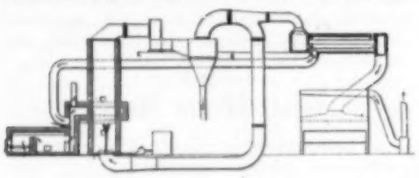
Review of Recent Patents

Acid-Proof Cement

An acid-proof cement particularly adapted for use in lining sulphite pulp digesters may be prepared as follows: A mixture of 60 parts of white clay, 10 of lime, 3 of infusorial earth, 3 of asbestos and 6 of borax is heated in a furnace; the cooled product is powdered and mixed with 10 parts of lead oxide. For use it is kneaded to a stiff mud with sodium silicate solution. The cement sets rapidly and has a low coefficient of expansion. (1,492,866, Naoki Takata, of Tokio, Japan, May 6, 1924.)

Spray Drying System

Liquid to be dried is sprayed up through a nozzle in the evaporating chamber shown at the left in the illustration. At some distance above the nozzle heated air is fed into the chamber through tuyeres. The air, vapor



Spray Drying System

and dry particles are withdrawn by means of a fan through the top of the chamber to a cyclone dust collector, where most of the dry material settles out. The air leaving the dust collector is divided into two portions, one returning to the base of the evaporating chamber and the other passing through a heat-interchanger (where fresh incoming air is preheated) to a final dust collector. The process is particularly adapted for working at high temperatures where chemical reactions are to be brought about in addition to drying. (1,491,026, Richard Guy Brindle, of Chicago, assignor to Corn Products Refining Co., April 22, 1924.)

Rustproofing Compound

Protective rust-resisting coatings may be formed on iron and its alloys by immersion from 40 minutes to 2½ hours in the following bath:

Water	40 gal.
Barium nitrate	18 oz.
Zinc oxide	9 oz.
Antimony trioxide	7 oz.
Oxalic acid	4 oz.
Phosphoric acid	5 oz.

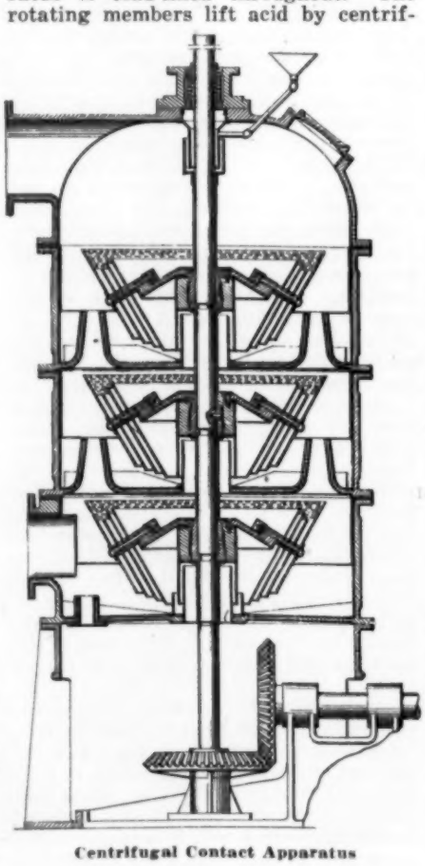
The bath is kept boiling while in use. Antimony or a compound of antimony is claimed as essential in this formula. (1,493,012, Charles E. Abraham, of Detroit, Mich., May 6, 1924.)

Phosphate Reduction in Electric Furnace

In the electric furnace smelting of phosphates, overheating, which contaminates the volatilized phosphoric anhydride with siliceous fume, is avoided by having a slag of such electrical resistance that passage of current from the electrodes through it will maintain the operating temperature at 1,200 to 1,500 deg. C. The charge contains natural phosphate, sand and coke, the following ratios being observed: For every lb. of silica, 1.4 lb. lime or 1 lb. magnesia; for every lb. phosphorus, 1 lb. carbon; for every lb. of iron as oxide, 0.32 lb. carbon. The furnace is charged continuously so as to give a uniform depth over its entire area of activity and the electrodes are kept in contact with the underlying slag bath. Consequently there is no arcing, and more uniform heating is obtained. Under these conditions, 95 per cent of the phosphorus charged will be reduced and the phosphorus pentoxide recovered will be free from other volatilized constituents of the charge. (1,492,713; Bethune G. Klugh, of Chicago, assignor to Federal Phosphorus Co., Birmingham, Ala., May 6, 1923.)

Eliminating Chambers in Sulphuric Acid Manufacture

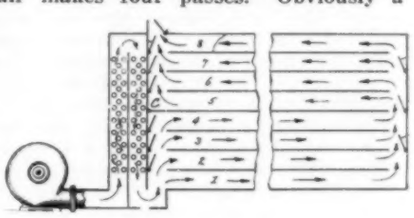
An example of the possibility of applying principles developed in one chemical engineering industry to the problems of another is the suggestion of Howard C. Freedenburg, of Baltimore, Md., to use the centrifugal scrubber familiar to the gas industry in the manufacture of sulphuric acid, thereby eliminating the cumbersome chambers. For this purpose the apparatus is lead-lined throughout. The rotating members lift acid by centrifugal force and throw it out as a fine mist or spray through which the reacting gases must pass. These enter at the bottom and pass up through the sprays. The intimate gas and liquid contact increases the reaction rate. (1,493,525, assigned to Bartlett, Hayward Co., Baltimore, May 13, 1924.)



Centrifugal Contact Apparatus

Drier

Variation in the amount of air passed at constant velocity and temperature over the material to be dried is possible with a drier described by Archibald F. Wright, of East Orange, N. J. Applied to a drier containing eight horizontal compartments, the system of control is as follows: At the ends of the compartments are adjustable dampers that determine the channels of air flow. During the first stages of drying, when the moisture content of the material is relatively high, a large volume of heated air is circulated by arranging the dampers as shown. The air thus makes two passes through the drier. Later the dampers are so arranged that the air makes four passes. Obviously a



Drier

smaller volume is required at the same velocity. At a still later stage, when only a very small amount of water remains, the dampers are again changed so that eight passes are given, the value being reduced again. (1,494,092, assigned to Industrial Dryer Corp., Newark, N. J., May 13, 1924.)

Petroleum Sulphonate Detergents

It has been found that when the processes disclosed in the Humphreys patent, 1,286,179, Nov. 26, 1918, and in the Petroff patent, 1,233,700, July 17, 1917, are applied to American petroleums, the alkali metal sulphonates resulting from the treatment of petroleum with fuming sulphuric acid are not sufficiently soluble in water to be used readily as detergents. Robert E. Divine, of Cincinnati, finds that these products may be refined.

For example, the semi-liquid or viscous product obtained by the Petroff process is freed from water by boiling in a steam jacketed vessel until substantially all of the water is removed. The dry product thus obtained then is treated with 70 to 100 per cent alcohol by mixing and thorough stirring. The mixture is allowed to settle with the formation of two layers, one containing an alcoholic solution of alkali metal sulphonates and the other layer comprising oil containing a small amount of alkali metal sulphonate. The two layers are separated by decantation or otherwise and the alcoholic solution is distilled to recover the alcohol, the residual material being a neutral alkali metal sulphonate com-

pound, substantially free from oil and sufficiently soluble in water to enable it to be employed directly for detergent purposes. The product is semi-pasty, similar in physical characteristics to soft soap, and possesses high detergent properties. Being free from uncombined alkaline or acid constituents and having good detergent properties toward greases and other foreign matter or dirt ordinarily present in soiled fabrics, it constitutes an excellent cleansing medium for the most delicate fabrics. (1,493,111, May 6, 1924.)

Halogenated Latex

Latex may be chlorinated to give useful products by means of a process developed by Ernest Hopkinson, of New York. Kieselguhr (100 parts by weight) is agitated with 150 parts water to which has been added 9 parts concentrated ammonia. Latex (100 parts containing 36 per cent solids) is added and thoroughly mixed. Excess water is removed by pressing and the material, dried at 200 deg. F., is treated with chlorine until 20 to 24 per cent by weight has been absorbed. Aëration, neutralization with ammonia, washing to remove ammonium chloride and drying complete the preparation of the material. It may be molded into shapes by pressing; these are hard and not affected by water, oils or gasoline. (1,491,265, April 22, 1924.)

U. S. Patents Issued June 3, 1924

Process of Preparing Pure Zinc-Sulphate Solutions. Frederick Laist, Anaconda, and James O. Elton, Great Falls, Mont., assignors to Anaconda Copper Mining Co., Anaconda, Mont.—1,496,004.

Manufacture of Imitation Leather and the Like. John J. Warren, Bronxville, N. Y.—1,496,040.

Carbonization of Coal. Stewart R. Illingworth, Bryn Fedwen, Radyr, Wales, assignor to Illingworth Carbonization Co., Ltd., Manchester, England.—1,496,053.

Plant for the Carbonization of Coal. Stewart R. Illingworth, Bryn Fedwen, Radyr, Wales, assignor to Illingworth Carbonization Co. Ltd., Manchester, England, 1,496,054.

Recovery of Gasoline. Nathaniel E. Loomis, Elizabeth, N. J., assignor to Standard Development Co.—1,496,061.

Method and Apparatus for Galvanizing. Wayne Rawley, Pittsburgh, and Orand A. Pluskey, Millvale, Pa., assignors to Blaw-Knox Co., Pittsburgh, Pa.—1,496,069.

Process for Preparation of Dyestuffs Which Consists in Treating Dinaphthylenethiophene by Sulphuric Acid, Etc. Karol Dziewonski, Cracow, Poland.—1,496,084.

Process for the Preparation of Dyestuffs Consisting in Treating Decacyclene With Sulphuric Acid. Karol Dziewonski, Cracow, Poland.—1,496,085.

Container for the Dry Cooling of Coke. Arnold Moetteli, Oberwinterthur, Switzerland, assignor to the Firm of Gebruder Sulzer Aktiengesellschaft, Winterthur, Switzerland.—1,496,094.

Glass Manufacture. Elmer Davis, Okmulgee, Okla.—1,496,151.

Separation of Soluble Salts. Clinton F. Dolbear, San Francisco, Calif., assignor to Industrial Research Co., San Francisco, Calif.—1,495,152.

Method of and Apparatus for Transporting Materials. Elgie C. Auld and Gustave E. Huttle, Scottdale, Pa.—1,496,196.

Non-Flammable Celluloid. John J. Aurynger, Brooklyn, N. Y.—1,496,198.

Crusher. Edward H. Frickley, St. Louis, Mo., assignor to Dixie Machinery Manufacturing Co., St. Louis, Mo.—1,496,213.

Sealing Means for Rotary Pumps. Ebenezer Hill, South Norwalk, Conn., assignor to the Hill Compressor & Pump Co., New York, N. Y.—1,496,222.

Filtering Medium. William Jones, New York, N. Y., assignor to Vesta M. Jones, New York, N. Y.—1,496,229.

Apparatus for Smelting Phosphatic Materials. Bethune G. Klugh, Anniston, Ala., assignor to Federal Phosphorus Co., Birmingham, Ala.—1,496,230.

Electric-Smelting-Furnace Construction. Bethune G. Klugh, Chicago, Ill., assignor to Federal Phosphorus Co., Birmingham, Ala.—1,496,231.

Stock Feeding and Distributing Apparatus for Electrical Furnaces. Bethune G. Klugh, Chicago, Ill., assignor to Federal Phosphorus Co., Birmingham, Ala.—1,496,232.

Method of Separating Soluble Salts. Clinton E. Dolbear, San Francisco, Calif., assignor to Industrial Research Co., San Francisco, Calif.—1,496,257.

Treatment of Leucite Rocks. Francesco Giordani, Naples, Italy, assignor to Pomilio Brothers Corp., New York, N. Y.—1,496,264.

Rotary Pump. Norman G. Beckwith, Hampton, England, assignor of one-third to Walter Pelmore, Haslemere, Surrey Co., England, and one-third to Walter M. Nones, Long Island City, N. Y.—1,496,291.

Vapor Extractor. Gaston A. Bronder, Brooklyn, N. Y., assignor of one-half to Thomas Costigan, New York, N. Y. Lucia R. Bronder, administratrix of said Gaston A. Brondel, deceased.—1,496,293.

Process and Apparatus for Coating Metal Articles. Harvey F. Girvin, Ansonia, Conn.—1,496,309.

Apparatus for Dehydrating. John H. Elspass, Wichita, Kan., assignor of one-third to M. Josephine, Maloney, Oklahoma City, Okla.—1,496,370.

Distilling Apparatus and Method. Paul H. Todd, Kalamazoo, Mich., assignor to A. M. Todd Co., Kalamazoo, Mich.—1,496,392.

Process for Collection of Metallurgical Fume. Charles A. Doremus and William M. Grosvenor, New York, N. Y.—1,496,410.

Carbonization of Carbonaceous Materials. Edmund O. Rhodes and Paul Wible, Chicago, Ill., and Ralf B. Trusler, Pittsburgh, Pa., assignors to American Tar Products Co., Chicago, Ill.—1,496,431.

Apparatus and Method for the Thermochemical Treatment of Materials. Charles B. Jacobs, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,496,467.

Enameled Ware. Harold F. Whitaker, Carneys Point, N. J., and Theodore Baker, Wilmington, Del., assignors to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,496,505.

Production of Electrodes for Galvanic Batteries. Harold N. Cox, Glen Ridge, N. J., assignor to New Jersey Patent Co., West Orange, N. J.—1,496,526-8.

Process for Producing Ferric Pigments. Harold F. Saunders, Cleveland, O., assignor to Chemical Specialties Co., Cleveland, O.—1,496,605-6.

Process for Producing Ferric Oxide. Harold F. Saunders, Cleveland, O., assignor to Chemical Specialties Co., Cleveland, O.—1,496,607.

Retort for Gasifying Oil and Tar. John E. Sharp and Alvin J. Bassett, Milwaukee, Wis.—1,496,609.

Grinding Mill. Harry E. Asbury, Melrose Park, Pa., assignor to Enterprise Manufacturing Co., of Pennsylvania, Philadelphia, Pa.—1,496,613.

Machine and Process for Mixing or Masticating Rubber and Like Material. David R. Bowen and Carl F. Schnuck, Ansonia, Conn., assignors to Farrel Foundry and Machine Co., Ansonia, Conn.—1,496,620.

Apparatus for Manufacturing Ice. Noah Coate, Greenville, O.—1,496,625.

Pump. Franklin H. Hertzler, Lancaster, Pa.—1,496,633.

Mixing, Incorporating and Disintegrating Machine. Guy C. Hurrell, London, England.—1,496,641.

Method and Apparatus for Distilling Pyroligneous Acid and Evaporating Acetate of Lime. Harry C. Merriam, Newton, Mass., assignor to E. B. Badger & Sons Co., Boston, Mass.—1,496,649.

These patents have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Concentrating Solutions by Crystallizing Hydrated Salts

Solutions of volatile substances such as acetic acid may be concentrated without distillation by removing some of the water from the solution as water of crystallization. Frank E. Lichtenthaeler, of Newton Highlands, Mass., who has been studying this method, finds that salt cake is particularly well adapted for this purpose. It takes up 1.2 times its weight of water in forming the hydrate and the anhydrous material may be recovered merely by heating above the transition point, 33 deg. C., when the anhydride separates in crystalline form. As an example, 100 lb. salt cake may be added to 100 lb. of 10 per cent acetic acid. After cooling, the concentrated acetic acid solution is removed from the mass of glaubers salt crystals by counter-current extraction, using a saturated solution of sodium sulphate. (1,492,718, May 6, 1924.)

Book Reviews

Russian Ammonia-Oxidation Plant

THE CONTACT PRODUCTION OF NITRIC ACID. By *A. K. Kolosoff*. 61 pages, illustrated. Published by the Scientific-Technical Division of the Supreme Council of National Economy, Petrograd, 1923.

This work is a detailed account of the construction and operation of the first Russian plant for the catalytic oxidation of ammonia to nitric acid. In a short introduction V. Ipatieff reveals the fact that the Russians were the first among the Allies to put up any such plant during the period of 1915-16. The production of very large quantities of ammoniacal liquor at the coke ovens of the Donetz basin suggested the idea of the oxidation of the ammonia content of nitric acid. Kolosoff gives data covering laboratory experimentation with 20-mm. tubes, technical tests with 90-mm. tubes, the operation of an experimental plant with catalyst tubes of 150 mm., and the operation of a complete plant consisting of 42 catalytic units, each containing platinum nets of 300 mm. diameter.

The experimental and technical difficulties encountered included the melting of the iron catalysts that were first used, ammonia escaping oxidation in passing through the contact mass, and the use of improper proportions leading to the decomposition of ammonia to nitrogen. Before large-scale operations were attempted a yield of 94.9 per cent was achieved by the proper arrangement of the factors involved.

In the experimental plant the problem of obtaining fairly pure ammonia

gas from different types of ammoniacal liquor was solved by the development of a process for the decomposition of ammonium salts with steam and lime, and purification of the resulting gases (containing about 90 per cent ammonia) with caustic soda solution. Details of plant design proved to be important because of the necessity of careful measuring of proportions and volumes. The optimum speed of gas passage over the catalyst was determined to be more than 1 meter per second, the time of contact being as low as 0.0005 second. With a concentration of 6 to 8 per cent ammonia in air it was possible to obtain acid of specific gravity 1.4. In the case of some ammoniacal liquors that contained sulphur compounds, small amounts of sulphuric acid were also formed.

The author has included a large amount of construction and operating data on the final plant, which cost about $6,000,000. A translation of this work would certainly be of considerable value to those interested in the practical problems of contact nitric acid production.

WILLIAM MARIAS MALISOFF.

Important Articles in Current Literature

"Purifying Iron Ore by Chemical Methods." *A. J. Moxham.* Results of recent work on Delaware greensands, using an acid leach, with subsequent washing for the separation of iron, potash and alumina. *Iron Age*, June 5, 1924, pp. 1637-1639.

"Contact Filtration Likely to Become Important Feature in Refining." *W. S. Zehrung.* Review of process with results of tests of different clays in decolorizing lubricating oils. *Nat. Petr. News.* June 4, 1924, pp. 27-30.

"Chromium: Its Uses and Its Alloys." *Walter M. Mitchell.* The first of a series of articles describing the properties and uses of chromium and many of its alloys and compounds. *Forging-Stamping-Heat Treating*, May, 1924, pp. 199-202.

"The Engineer in Relation to the Petroleum Industry." *H. Barringer.* Presidential address before Institution of Petroleum Technologists stresses principally problems of production and transportation. *J. Inst. Petr. Technogolists*, April, 1924, pp. 168-182.

"The Hypochlorite Process." *A. E. Dunstan.* An unusually comprehensive review of development and operating procedure. *J. Inst. Petr. Technologists*, April, 1924, pp. 201-15.

"Comparison of the Various Processes for the Direct Synthesis of Ammonia." *P. Firmine.* Greenwood process of Synthetic Ammonia and Nitrates, Ltd., is compared with the De Jahn process of the General Chemical Co. at the Sheffield plant, Muscle Shoals. *L'Industrie Chemique*, May, 1924, pp. 200-2.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials or other topics of interest

Wisconsin's Unique Graduate Course in Milwaukee

To the Editor of Chem. & Met.:

Sir—In answer to your recent letter, the following details may be of interest to you regarding the graduate work that the metallurgical department of the University of Wisconsin is carrying on in Milwaukee.

A group of men, all of whom are graduates of engineering colleges and who are in responsible positions in industry in Milwaukee, asked that we initiate this work in the early part of last winter. After several preliminary conferences, the class was got under way by the Graduate School of the university, and it has gone on for a long enough time now to pass a fair judgment on its results.

The men are on the average considerably older than regular graduate students, the most recently graduated having finished his undergraduate work in 1919 and the one longest out in 1911. In all there are eight in the course, because a larger number could not be properly supervised, particularly in their research problems, and a selection was made of those who seemed the most earnest and persevering in their desire to take up the work. One man, a Rensselaer graduate, is general superintendent of a concern operating two malleable foundries; another, a Carnegie Tech. man, is works manager of a steel foundry; a Yale graduate is superintendent of a malleable foundry; a Michigan College of Mines man is metallurgist at a subsidiary plant of General Motors; a Wisconsin graduate is manager of a malleable foundry, and a Marquette man and a Yale man are metallurgists at malleables. The industries with which these men are connected helped in every way to promote the success of the course, financing the expenses of their individual employees and in some cases relieving the men of some of their other duties in order that they might be able to devote more time to research.

The work is carried out as follows: On Friday nights, a 3-hour seminar is held, every 2 weeks a course on the thermodynamics and kinetics of chemical reactions is given, and alternately with this a course on the physical chemistry of the metals. Thus there is a class every Friday evening. After class there is a general discussion and many times the class meetings have lasted until midnight. There is the greatest freedom at these open sessions for the men to discuss their problems, and they meet not as competitors in business, as during the day or in business hours, but as students discussing a common laboratory problem. The value of this free exchange of opinion alone, without considering any of the other aspects of the work, has entirely justified what in the beginning was an educational experiment.

On Saturdays, the instructors visit the different plants and have conferences with the individual students on their research project—plans, results, interpretation of results, etc. With the time that this takes, about two such visits can be made in a day.

The research projects are all problems of practical and economic importance, as well as being scientific investigations. For example, the steel foundry man is making a detailed study of the reactions taking place in basic electric steel furnaces and the malleable men are studying the mechanism of the reactions in the annealing operation and the influence of alloying substances and of impurities on annealing.

One of the concerns having a representative in the Milwaukee class has become sufficiently impressed with the practicability and value of the whole idea that it has given funds to establish a fellowship at the university to enable a man to carry on work at Madison on those phases of problems which we can do better here, supplementing in its own plant and laboratory in Milwaukee the work which can better be done at an industrial plant.

At the beginning this class was an experiment. It can be fairly said now that this is no longer the fact. Not alone has there been no dimunition of interest by the men, but interest has actually grown and developed as they see the direct application of theory in their own everyday work. The class work and the mutual reactions of the student group, one on the other, has very noticeably enlarged the intellectual horizon of the men. The success of the movement to date has exceeded the fondest hopes of those connected with it.

RICHARD S. MCCAFFERY.
Professor of Metallurgy.
College of Mechanics and Engineering.
University of Wisconsin,
Madison, Wis.

Books Received

Etching and Coloring Metals

DAS ÄTZEN DER METALLE UND DAS FÄRBEN DER METALLE (Etching and Coloring of Metals). By *Georg Buchner.* Third revised edition, 207 pages, illustrated. M. Krayn, Berlin. Price, $1.25.

Practical information on the surface treatment of metals is given in this book. Particularly complete details are given on mechanical, chemical and other methods for improving the surface appearance of metals by changing the color or physical character of the surface. It will be of interest to those who are confronted with the problem of finishing metal objects.

News of the Industry

Summary of the Week

Program announced for technical sessions of Denver meeting of American Institute of Chemical Engineers.

Questions of legal technicalities influence Congress to defer action on helium bill.

Dr. Grinnell Jones is appointed fourth member of party to investigate vegetable oils for Tariff Commission.

Cramton bill to establish a Prohibition Bureau in the Treasury Department was not acted on by Senate before adjournment.

Large attendance at National Fertilizer Association convention held at Asheville, N. C.

Exports of chemicals and allied products in April are officially valued at 20 per cent below the value of such exports in April, 1923.

There was a marked falling off in imports of coal-tar dyes through the port of New York in May.

Importer sustained by U. S. Court of Customs Appeals, in appeal from methods used by appraisers in levying duties on imports of dyes.

Decline in Coal-Tar Exports Feature in April Trade

Department of Commerce Figures Show Exports of Chemicals as 20 Per Cent Below April, 1923

In line with the slowing up of business in general the foreign trade of the United States in chemicals and allied products during April, 1924, recorded a loss from April, 1923, in both exports and imports. However, April of last year was one of the months notable for the large shipments made to and received from foreign countries. Whereas last year, beginning with March and continuing throughout the peak month of July, saw a big expansion in the exports but thereafter for the remainder of the year a steady reduction, this year has seen no big shipments as yet, the figure month by month having dropped slightly. The total exports for the month of April, 1924, were valued at $10,593,130, or 20 per cent below April, 1923.

Coal-Tar Products

One of the most striking features of the trade was the very small amount of coal-tar products shipped during the month of April, when but $475,747 worth left this country for foreign countries, the smallest for any single month since February, 1922. This loss was largely due to the big falling off in foreign sales of crudes; as for example, benzol, with 12,626 lb., valued at $934, in April, 1924, as compared with 251,358 lb., valued at $17,778, in April, 1923; and crude tar and pitch, with 6,659 bbl., valued at $24,403, as compared with 124,434 bbl., valued at $426,813. All things considered, the foreign demand for American colors, dyes and stains remained fairly constant, as shown by the exports of $344,605 (1,014,824 lb) in April, 1924.

Dye Imports at New York Declined in May

The imports of coal-tar dyes for May, 1924, through the port of New York, totaled 167,245 lb., with an invoice value of $165,521. In addition, 15,834 lb., valued at $12,032, was reported through the port of Boston.

IMPORTS OF DYES AT NEW YORK

Month	Lb.	Value
January	288,743	$232,571
February	158,874	176,657
March	293,862	302,016
April	174,880	182,253
May	167,245	165,521

The value of the imports of the group as a whole, although having recorded a loss of 6 per cent as compared with the previous year, was more than double the value of the exports, which fact was likewise due to the crudes, receipts of which made up approximately three-quarters of the total group and which showed an advance over the previous year. While the valuation of the amounts of colors, dyes and stains brought into the country this April showed a marked decline in amounting to slightly over one-half of that of a year ago, they were still $259,834 worth less than the amount exported.

Industrial Chemicals

Exports of industrial chemicals were off 23 per cent in April, 1924, from April, 1923, and had an aggregate valuation of $2,026,364, with very large gains having been made in some of the items included under this class, such as calcium carbide, bleaching powder, copper sulphate, dextrine and formaldehyde. But after the smallness of the shipments made last April the apparent tremendously large gains shown in this April are relatively unimportant. A reduction of 14 per cent occurred in foreign demand for acids and anhydrides, figures for which were $83,070 (1,938,023 lb.). Sales of sodas and sodium compounds fell short of the April, 1923, figure of $987,911 (36,605,402 lb) by $284,178 (11,558,305 lb.).

Pigments, Paints, Varnishes and Fertilizers

Although the total value of the pigment, paint and varnish group diminished from the April, 1923, figure 14 per cent, to $1,176,363, this was not remarkable. Exports of mineral earth pigments and carbon and lampblacks improved in quantities shipped but declined in values.

After the large total of last April for fertilizers and fertilizer materials the drop of 20 per cent in value and 4 per cent in quantity is insignificant, as the $1,761,353 (93,828 tons) dispatched to foreign countries in April, 1924, was about the monthly average of 1923. Imports, on the other hand, during April were considerably below the previous April and under the monthly average for 1923, although still in excess of the exports by $2,773,496, the total figure being $4,534,849 (111,815 tons).

Naval Stores

The value of the amounts of naval stores, gums and resins dispatched to foreign countries in April declined 17 per cent from the preceding April, to $1,466,527. Although only half as much spirits of turpentine reached foreign countries in this April as in last April, slightly more rosin was shipped. Figures for these two commodities were: spirits of turpentine, 360,228 gal., valued at $362,778; and rosin, 101,890 bbl., valued at $926,608. Heavier shipments of gums, resins and balsams were received in April, 1924, than in any other month of the current year, but at that, shipments were fewer than in April, 1923, total valuation being, $3,627,120, one-half of which was comprised of shellac.

Beet Sugar and Western Industry to Hold Stage at Denver Meeting of A.I.C.E.

Chemical Engineers Plan Extended Western Trip Featured by Interesting Visits to Metallurgical and Industrial Plants—Final Technical Program Announced

SIX outstanding papers on the technology and chemical engineering aspects of the beet sugar industry will afford the principal feature, from a technical viewpoint, of the meeting of the American Institute of Chemical Engineers to be held in Denver, July 15 to 18. The final program also reveals several other important discussions having particularly close bearing on Western industry.

The meeting in Denver, however, is not the only high spot of the chemical engineers' Western trip, which starts with the special train that leaves New York July 12 and includes on its long itinerary stops at Colorado Springs, Salt Lake City, Yellowstone, Los Angeles, San Francisco, Portland, Seattle, Glacier National Park, Sault Ste. Marie and Mackinack Island. The return to New York is scheduled for Aug. 26. At Los Angeles on Aug. 1 a joint session will be held with the Southern California Section of the A.C.S. and at a number of places en route local members of the Institute have arranged for receptions as well as visits to interesting industrial plants. Unusual features among the latter will include inspection of the hydrometallurgical operations of the Golden Cycle Mining & Reduction Co. at Colorado Springs and a visit to the copper mines and smelters of Bingham county, Utah. At Los Angeles the California oil fields, the cement works at Colton and Riverside and the nearby fruit-pack-plants will compete with Hollywood for the attention of the visitors.

The local committee which will have the Denver meeting in charge consists of John V. N. Dorr, chairman; R. W. Shafor, vice-chairman; E. C. Reybold, in charge of finances; Joseph Maudru and W. C. Graham, entertainment; W. M. Barr, transportation, and H. W. Dahlberg, plant inspection trips. Mrs. W. C. Graham, of Denver, chairman of the entertainment committee for the ladies, has arranged an interesting program of sightseeing and social gatherings.

Technical Papers and Discussion

The principal features of the technical program follow:

Tuesday, July 15 (All meetings at Brown Palace Hotel, Denver): "Disposal of Waste From Beet Sugar Industry," by Prof. Edward Bartow, State University of Iowa; "The Problem of Sugar Content in the Beet," by W. H. Baird, general manager, Northern Sugar Corporation; "Uses of Barium and Recovery of Sugar From Molasses," by H. W. Dahlberg, research manager, Great Western Sugar Co.; "Filtration as Applied to the Beet Sugar Industry," by Joseph Maudru, assistant to general superintendent, Great Western Sugar Co.

Wednesday, July 16: "Technical Accounting in the Sugar Industry," by H. E. Zitowski, general chemist, American Beet Sugar Co.; "The Hot Saccharate Process in the Beet Sugar Industry," by R. W. Shafor, superintendent research laboratory, Great Western Sugar Co.; "Physical Interpretation of Cottrell Electrolytic Precipitation Phenomena," by E. Anderson, chemical engineer, Western Precipitation Co.

Thursday, July 17: "Heat Transfer in Steam Jacketed Evaporators," by Prof. H. L. Olin, State University of Iowa; "Tyler Electric Silica Still," by Prof. J. C. Olsen, W. Lindenthal and I. Sherman, Brooklyn Polytechnic Institute; "Concentrating Dilute Nitric Acid," by Prof. Clifford D. Carpenter and Joseph A. Babor, Columbia University; "Chemical Engineering Aspects of Water Treatment for Railroads," by William A. Barr, consulting chemist, Union Pacific System.

Friday, July 18: "Refined Sulphurs, Their Manufacture and Uses," by Charles A. Newhall, consulting chemical engineer, Seattle; "Progress in the Application of Continuous Hydrometallurgical Methods in Chemical Industry," by J. V. N. Dorr, president, Dorr Co.

At Los Angeles, Aug. 1, Mary Louise Café, the joint program with the American Chemical Society will include a paper by Prof. Edward Bartow on "Sewage Disposal" and another on "The Principles and Problems of Multiple Effect Evaporation" by Hugh K. Moore, technical director, Brown Co.

Industrial Plant Visits

Among the industrial plants to be inspected are: Great Western Sugar Co., Brighton, Colo.; Denver Fire Clay Co. and Gates Rubber Co., Denver; Coors Porcelain Co., Golden, Colo.; William Ainsworth & Sons (manufacturers of precision instruments), Brecht Candy Co. and Burlington Railroad (new shops) of Denver; Golden Cycle Mining & Reduction Co., Colorado Springs; Utah Copper Co., Garfield, Utah; Riverside Portland Cement Co., Riverside, Calif.; California Cyanide Co., Los Angeles; American Beet Sugar Co., Oxnard, Calif.; and Del Monte Canning Co., Del Monte, Calif.

Georgia Clays for Rubber Fillers

A study of Georgia white clays with respect to their use as fillers in rubber has been completed by Bureau of Mines technologists. The purpose of this work, which was performed in cooperation with the Central of Georgia Railway, was to determine which Georgia clays, when properly prepared, are suitable for use in rubber compounding. Samples were collected from various deposits not now used in preparing rubber filler, as well as clay from those mines which are already producing clay for use in fillers. It was found that some of the clays were suitable for use in making high-grade rubber.

Fertilizer Association Imbued With New Spirit

Determination to Correct Conditions Causing Depression in the Industry Evident at Annual Convention

The largest convention of the National Fertilizer Association since 1920 was held at the Kenilworth Inn, Asheville, N. C., June 9 to 14. Every officer and every member of the executive committee were present and aided in harnessing the enthusiasm of the members for effective work.

In his keynote speech President Gustavus Ober, Jr., announced that the time for useless talk was over and recommended the appointment of a committee to formulate principles of action that will avoid disaster. He recommended also the expenditure of $500,000 for work on soil improvement in co-operation with farmers.

Timely Points in Addresses

W. J. Spellman, of the U. S. Department of Agriculture, showed that the law of diminishing returns in the application of fertilizer would not begin to operate until twice the present applications had been reached. He emphasized the great need of more experimental work to determine analysis of fertilizers that should be used and optimum quantities.

William D. Hurd, director of the soil improvement committee of the association, discussed in his report the necessity of a stronger educational effort, because the knowledge of what constitutes soil fertility is so new and so many readjustments must be made between the fertilizer industry and agriculture as a consequence. The responsibility for development of this knowledge rests with the industry fully as much as with colleges and experiment stations and upon this development depends the growth of the industry itself.

L. H. Sturtevant, of Boston, emphasized the necessity of studying all factors of production equipment, especially depreciation replacement, standardization and new methods that promote efficiency and economy. It is essential to keep alert and never to shut one's eyes to possible improvement.

The new activated sludge plant of the city of Milwaukee was described by V. H. Kadish, engineer for the Milwaukee Sewerage Commission. Such a plant furnishes to the fertilizer industry the much-needed organic ammoniates.

The meeting of active members on Thursday discussed sales service and cost accounting. This latter, it is felt, will be the most important single factor in stabilizing the industry. If a manufacturer knows his costs he is less likely to sell below costs of production.

Action on Helium Bill Deferred

The helium bill is among the subjects carried over by Congress until the winter session, which will begin Dec. 1. Several members of the Senate Committee on Mines and Mining had raised certain questions regarding legal technicalities, and this led to a decision to take no action until later.

Washington News

Staff for Vegetable Oil Investigation Completed

Tariff Commission Appoints Dr. Grinnell Jones Fourth Member of Investigating Party

The Tariff Commission has completed its staff which will be sent to Europe and subsequently to British India and Ceylon in the vegetable oil investigation, by the appointment of Dr. Grinnell Jones, formerly chief of the Chemical Division and now a consulting specialist of the commission, as the fourth member. The others of this party, previously announced, are R. H. Cragg, of the Chemical Division, and Marryn Braun, and A. T. Geraci, accountants. This party will sail June 28 to investigate cottonseed oil, peanut oil and coconut oil.

The party that will investigate coconut oil and soya bean oil in the Far East will sail from San Francisco, July 7. This party consists of C. H. Penning and Dr. Frank Rutter, of the Chemical Division, and E. M. Whitcomb, accountant.

Although the commission has not definitely decided the full extent of its vegetable oil inquiry, which is to be made as a result of applications for reductions in duties on certain of the oils filed under the terms of the flexible tariff by the Bureau of Raw Materials, representing paint and soap manufacturers, it is evident that the cost will be high. The commission reported to the Senate in response to a resolution inquiring if it needed additional funds to conduct inquiries under the flexible tariff in which applications had been filed that it had not acted upon forty-five bona fide applications because of lack of funds. While the commission did not state that it would docket for investigation all of the forty-five pending applications, it estimated that to undertake the investigations, if all were investigated, would cost $396,000.

Cost of Investigations

In connection with this report, the commission gave the Senate information as to the cost of certain investigations which it has made or which it has ordered to be made. Among the latter was the vegetable oil inquiry, which the commission stated is estimated to cost $45,595, of which $30,595 would be expended for field work, the remainder being the estimated cost of office work and overhead expense. In this estimate the commission included only the cost of investigating cottonseed oil, soya bean oil, peanut oil and coconut oil. If the commission orders other oils investigated in similar manner, as it may do, having referred the question of substitution to its Chemical Division for further report, the total cost of this investigation will be in excess of the $45,000 estimate.

The commission's report showed that the investigation into costs of producing sugar, which has been in progress more than a year and is now being considered by the commission for a final report to the President, cost $73,630, of which $43,630 was for field work. A survey of sugar beets, a separate inquiry and not directly concerned with the sugar investigation, cost $45,000, of which $27,306 was for field work. The wheat investigation cost $35,680, the commission reported, and it was estimated that an inquiry into butter, as had been requested by Senator Magnus Johnson of Minnesota, would cost $37,000.

The commission further disclosed in its report that while it has investigated thirty-seven commodities under the flexible tariff, the final work on some of these has been suspended owing to lack of funds and the necessity of pushing ahead inquiries of greater importance.

Importer Wins Appeal on Duties Assessed on Dye Imports

In a unanimous opinion handed down by the U. S. Court of Customs Appeals, the case of Kuttroff, Pickhardt & Co., of New York, was remanded to the Board of General Appraisers to enable it to make its findings of fact and conclusions of law as provided by statute.

The case involved an importation of dyes, known as crystal violet extra, imported by Kuttroff, Pickhardt & Co. and entered at $3 a lb. and appraised at $3.75 a lb., held by the appraisers to be 1 1/9 times the strength of but competitive with a domestic dye known as crystal violet 6-B and sold at $2.85 a lb. The importers contended that while the imported dye was held by the appraiser to be 1 1/9 times greater in strength than the domestic it was appraised at the rate of 1¼ times—that is, 25 per cent was added to the American selling price in arriving at the basis for assessment.

This importer also had appealed from the appraiser's decisions relative to duties assessed on importations of azoflavine, benzo red and indanthrene powder. The appeals were regarded as of wide importance as test cases to establish the legality of the provisions of the law which provides methods of assessment of duties on dyes and coal-tar products.

Returned War Materials Exempt From Customs Duties

A House bill authorizing the remission of all unpaid customs duties on War Department materials returned from France after the armistice was passed by the Senate shortly before adjournment. This law eliminates a bookkeeping charge of several hundred thousand dollars which the Treasury Department made against the War Department on account of the phraseology of the tariff act, which provided that exported commodities which were changed in nature abroad must pay duty if returned to the United States. The materials on which duty was assessed consisted largely of ordnance equipment, tractors, chemical warfare supplies and electrical equipment for the Signal Corps which were exported as separate elements and put together in France or England.

Electrolytic Soda Production in Italy

Reports to the Bureau of Foreign and Domestic Commerce say that there were two manufacturers of electrolytic soda in Italy prior to the war, one employing the old diaphragm process and the other using the Kellner-Solvay mercury process. The output of soda was not increased, because of the difficulty of disposing of the byproduct, chlorine. The industry expanded rapidly during the war, due to the increased demand for chlorine and for caustic soda by the manufacturers of explosives. The daily production at present is 83 tons of caustic soda and 68 tons of chlorine. Five large plants and a number of small ones are in operation. The domestic and export demand for chlorine has increased since the war, in the form of calcium hypochlorite. Italy imported 8,464 quintals of this product in 1922, and 13,178 quintals during 1923. The exports for 1922 were 21,519 quintals, and 26,770 quintals during 1923. Italy is obliged to import large quantities of caustic soda chiefly from France, but imports also from the United States, Spain and Great Britain. Her present consumption of this product amounts to more than 400,000 quintals per annum, while her production is about 200,000 quintals.

Opium Importation Act Amended

The House bill amending the opium importation act so as to prohibit importations of crude opium for the purpose of manufacturing heroin was passed by the Senate on the last day of the recent session of Congress. The measure was signed by the President and becomes effective at once. There was only brief debate on the bill in the Senate, Senator Smoot calling up the measure and asking unanimous consent for its consideration on the ground that unless the United States took action of this character before the convention to be held in Europe soon, its voice would have little weight in that conference.

Polish Wood Chemical Products Less Active

A report from the U. S. Trade Commissioner's office at Warsaw states that the Polish production of timber for chemical uses has considerably declined as a result of slack demand in the export market. England, formerly Poland's best customer, has curtailed orders for acetate of lime, acetone and methanol. Exportation to France of methanol and acetone is handicapped, because these products are not included in the list of favored commodities in the Franco-Polish commercial treaty.

The domestic demand has not been developed to any extent, due to the small number of factories which use these materials. Acetate of lime, however, is required for the local vinegar factories. The market possibilities of wood tar have greatly improved, with the resumption of work in the shipyards, and its use for tarring rope.

News in Brief

Engineering Students on Tour—Students in the mining engineering department at the West Virginia University, Morgantown, W. Va., are making a 2 weeks tour of various plants and properties in eastern and central Pennsylvania, under the direction of Prof. A. C. Callen, head of the department, and his assistant, Prof. C. E. Lawall. The party, made up primarily of juniors and sophomores, will visit the works of the Bethlehem Steel Corporation, Bethlehem; New Jersey Zinc Co., Palmerton; cement mills in the Lehigh Valley district; powder mills in the vicinity of Allentown; stone quarry at Slatington; iron plants and coal properties in the vicinity of Wilkes-Barre, Scranton and Carbondale, and other points of industrial interest.

License for Coal-Tar Imports Into Japan—By a decree effective June 7, import licenses are required on all coal-tar dyes and distillates, except medicinals, entering Japan from Germany and other countries not having commercial treaties with Japan.

Tanning Plant Reopens—The Lookout Extract Works, Chattanooga, Tenn., specializing in the manufacture of tanning extracts, has resumed operations after a shutdown for about a year past. It is expected to give employment to a normal working force at an early date.

Chemical Societies Meet—The Northeastern Section of the American Chemical Society held a joint meeting with the Rhode Island Section of the society at the plants of Bird & Son, Inc., East Walpole and Norwood, Mass., on June 6, afternoon and evening. The gathering was the 195th meeting of the Northeastern Section. The program included a trip through the Bird plant, devoted to the manufacture of paper roofing, etc.; athletic games and a social time at the Norwood Civic Club, and a dinner at the same club house. G. J. Esselen is chairman of the Northeastern Section.

Activity of Oil Refineries—Of a total of 303 oil refineries in the mid-continent field, comprising the states of Oklahoma, Kansas, Texas, Missouri, Arkansas and Louisiana, 164 plants are on the active producing list at the present time, with a capacity of 938,415 bbl. per day. The average operation is on a basis of 80 to 85 per cent of maximum. The idle plants, numbering 136, are for the most part the smaller refineries, with aggregate rated output of 217,150 bbl. daily. The total still capacity of all plants in this section is 1,222,065 bbl. per day, including three refineries with a rating of 12.500 bbl. daily not entirely complete at the present time.

Ford Chemical Plant Nearing Completion—The Ford Motor Co., Highland Park, Detroit, Mich., is completing the erection of its new chemical works at Iron Mountain, Mich., and purposes to place the plant on the producing list before the close of the month. It will have a capacity for handling 210 cords of wood daily, to be manufactured into byproducts, and the ultimate output of the plant, it is said, will exceed that of any similar works in existence. Power will be furnished from a hydro-electric generating plant to be located on the Menominee River.

Smaller Sales of Explosives—Explosives used in the United States during April, 1924, amounted to 363,844 kegs of black blasting powder, 3,807,811 lb. of permissible explosives and 22,849,979 lb. of other high explosives, according to reports of manufacturers to the Bureau of Mines. A comparison based on the returns of identical companies indicates a smaller volume of sales of all three classes of explosives in April, 1924, than in April, 1923.

Produce High Alumina Cement—The Atlas Aluminate Cement Co., 25 Broadway, New York, recently organized as an interest of the Atlas Portland Cement Co., has commenced operations at Northampton, Pa., the site of the principal mill of the parent company, for the manufacture of a high-alumina cement, commonly referred to as French quick-setting cement. Several patents have been secured covering the production in this country.

Larger Output of Lead—Revised figures of the Geological Survey show total output of refined primary lead in the United States in 1923 was 618,322 short tons, compared with 532,662 tons in 1922. Apparent domestic consumption in 1923 of primary lead was 481,212 tons, compared with 536,560 tons in 1922. Primary lead from domestic ores in 1923 came to 543,841 tons, compared with 468,746 tons in 1922.

New York Chemists Club Will Award Scholarships—Two scholarships open to students of industrial chemistry and chemical engineering in every state will be awarded this summer by the Chemists Club of New York. They are the Bloede scholarship, with an income of $500 annually, founded by Dr. Victor G. Bloede, of Baltimore, and the Hoffmann scholarship, with an income of $500, established by William H. Hoffmann, of Newark. Work may be pursued at a school or university approved by the scholarship committee, of which Dr. F. G. Zinsser of Hastings-on-Hudson, N. Y., is chairman.

Production of Tire Casings in April—Production of tire casings in April exceeded shipments by 294,037, according to reports from members of the Rubber Association, representing about 80 per cent of the industry. Output in April totaled 3.307,478, compared with 3,427,692 in March and 3,539,326 in April, 1923. Shipments in April this year were 3,013,364, against 2,990,872 in March and 3,079,743 in April last year. Inventory on April 30 was 6,164,226, compared with 5,763,084 in March and 6,088,272 at close of April, 1923.

Phosphate Rock Companies Win Suit

Phosphate rock when taken from quarries or open pits is not mined within the meaning of the state mine inspector law of 1915, and fertilizer companies are not subject to payment of mine inspection fees, according to an opinion handed down recently by Chancellor James B. Newman at Nashville, Tenn., in the case of Federal Chemical Company et al. vs. George B. Thomason, state comptroller, et al.

The legislature of 1915 passed the law requiring that the state mine inspector inspect all mines, the owners to pay for such inspections. Phosphate rock quarries were not inspected under that law until 1920, when the first inspections were made and the owners charged with the usual inspection fees. The fees were not paid and later distress warrants were issued through the revenue departments and the owners paid under protest.

The suit in which Chancellor Newman filed his opinion was joined by the following companies: Armour Fertilizer Works, Federal Chemical Works, Hoover & Mason Phosphate Co., Charleston, S. C. Mining & Manufacturing Co., and the International Agricultural Corporation.

Lack of Appropriation Delays Oil-Shale Development

Among the public projects necessarily delayed because of the failure of Congress to enact the second deficiency appropriation bill is the proposed plant to be operated by the Bureau of Mines for the development of oil shale. The Senate attached to the deficiency bill an item of $90,000 for this purpose. The entire bill failed of enactment because of a filibuster in the Senate in the last half hour of the session over elimination of a reclamation project

F. T. C. Hears Final Arguments in Procter & Gamble Case

The Federal Trade Commission on June 12, listened to final arguments in its complaint against the Procter & Gamble Co. involving the use of the word "naphtha" in advertising and selling certain kinds of soap. J. W. Addison, trial examiner, and W. C. Reeves, attorney for the commission, requested that a cease and desist order be issued against the soap company.

Mr. Reeves contended that for a period of 8 years up to the fall of 1920, the Procter & Gamble Co. advertised the "P & G White Naphtha Soap" as containing naphtha, when as a matter of fact it contained kerosene, and that while since 1921 the company has used what purports to be naphtha it actually is not, according to the testimony of various chemists. A similar charge was made with respect to "P & G White Naphtha Soap Chips" and "P & G Washing Powder."

Frank F. Dinsmore, attorney for the Procter & Gamble Co., contended that naphtha was a genuine name for products of petroleum. He maintained that there was no evidence to support a charge of misbranding.

Senate Takes No Action on Cramton Bill Before Adjournment

Passage of Bill by Last House Had Not Been Expected—Senate Committee May Hold Hearings Before Reporting Bill at Next Session

NO ACTION was taken by the Senate prior to adjournment of Congress on the Cramton bill to establish a Prohibition Bureau in the Treasury Department independent of the Bureau of Internal Revenue, of which the prohibition agency is now a unit. It is expected that hearings will be held by the Senate committee before the bill is reported at the next session, in view of the developments which marked passage of the bill in the House.

The bill was brought up in the House after the impression had been given that it would not be pressed. Representative Cramton, the author of the bill, in explaining the situation to the House said that "the report of the committee carries an amendment that I have not been able to accept in full, although I have gone just as far as I could in my desire to get together with what is known as the industrial alcohol interests. The amendment was intended to relieve the fears of some industrial users of alcohol, but I have been afraid it goes so far as to defeat the purpose of the bill. I am afraid the amendment in effect would take this Division of Industrial Alcohol out of the bureau."

Argument Against Further Burdens on Industrial Alcohol

Representative O'Sullivan of Connecticut presented a particularly effective argument against any further burdens being placed on the production or consumption of industrial alcohol. He charged that the proponents of the bill are violating the spirit of the Volstead act in their attitude toward industrial alcohol. He pointed out that the law encourages the manufacture of alcohol for industrial, scientific, mechanical and medicinal purposes. He said that the manufacturers of such things as dyes and artificial silk are being treated as bootleggers because they must make use of alcohol. He summarized the arguments against the bill as follows:

First. The passage of the bill would deprive legitimate users and dealers of the right of appeal to the Commissioner of Internal Revenue from unnecessary rulings and regulations promulgated by the Commissioner of Prohibition. They base their predictions of the future on the actions of that individual in the past, when, in his desire to enforce the law, he surrounded the legitimate users with regulations so unwarranted and unreasonable as to call for an immediate reversal on the part of his superior.

Second. It would give a free hand to officials whose chief concern is the pursuit of the law violator, and who, as demonstrated by experience, would give little consideration or attention to the needs of the manufacturers employing alcohol as a raw product.

Third. It would take the administration of the law away from the Commissioner of Internal Revenue, who has acquired vast knowledge and experience in the industrial and commercial use of alcohol, and place the matter in inexperienced hands.

Says Present Remedies Would Be Lost

Fourth. In the past drastic, unnecessary and arduous rulings of the Prohibition Commissioner have been modified or eliminated in a number of instances only through appeal to the Commissioner of Internal Revenue. This remedy would be lost and no appeal would lie except to the Secretary of the Treasury, an individual so far removed from the operation of the machinery of enforcement as to serve only as a rubber stamp for the contemplated new official.

Fifth. The administration of the Bureau of Internal Revenue has been most competent, affords ample protection to the government, and through the technical knowledge and experience gained in years of handling such matters, that department is able to administer the law justly to all trades.

Sixth. It would place the administration of the law solely within the hands of one man, and no man should sit in judgment on matters which concern the legitimate business life of innumerable industries.

Seventh. Business men now know where they stand with reference to the regulations necessarily following in their lines of industry. This new bureau would serve only as an obstacle and meddler in legitimate industry.

Eighth. Denatured alcohol is poisonous, can not be used as a beverage, and should not be treated as such.

Representative O'Sullivan charged that insistence on giving the Prohibition Commissioner absolute control over industrial alcohol is rampant fanaticism and declared that "prohibition with all the wealth of good its advocates proclaim it possesses must not be the monkeywrench to ruin the gears of industry."

Representative Graham of Pennsylvania made a plea that honest business be freed from the prosecution to which it is being subjected.

Tire Plant Adopts Maximum Operating Schedule

The Kelly-Springfield Tire Co., Cumberland, Md., has adopted a maximum operating schedule at its local plant, running on a three-shift day basis with employment of full working force. Orders on hand insure this rate of output, it is stated, for some time to come. The plant was completed in 1921, and has recently been expanded with the installation of machinery for balloon tire production, now being developed at the rate of 2,500 per day.

Financial

The American Window Glass Machine Co. of Pittsburgh has declared an extra dividend of 1 per cent on the common, in addition to the regular quarterly dividend of 1¼ per cent and 1¾ per cent on the preferred.

The Devoe & Raynolds Co. has declared an extra dividend of 25 cents and regular quarterly dividend of $1.25 on common; also regular quarterly of 1¾ per cent on first preferred and 1¾ per cent on second preferred stocks.

The Air Reduction Co. has declared a regular quarterly dividend of $1 per share, payable July 15.

The report of Fisk Rubber Co. for 6 months ended April 30, 1924, shows net income of $754,760 after depreciation, interest and federal taxes, equivalent to $3.98 a share earned on outstanding $18,924,000 first preferred stock, upon which there is an accumulation of 21 per cent in back dividends.

Advices from London steate that a general meeting of the Dunlop Rubber Co. will be held today, at which resolutions will be submitted to reduce capital from £20,000,000 to £9,322,457½.

At the annual meeting of the Westinghouse Electric & Manufacturing Co., held June 11, the stockholders voted to increase the capital stock from $125,000,000 to $200,000,000, the increase to consist of common stock.

Trade Notes

The Orford Soap Co., Manchester, Conn., is advancing production at its plant, adopting a schedule of 9 hours per day and 5 hours on Saturday. To encourage regular attendance, a 10 per cent bonus is to be given, with addition of the regular Christmas bonus distributed at that time of year, as heretofore.

The Grasselli Dyestuff Corporation has been incorporated at Wilmington, Del., with an authorized capital stock of $4,000,000. The new corporation will take over the dyestuff production and business of the Grasselli Chemical Co.

C. C. Speiden, of Innis, Speiden & Co., recently returned from an extensive trip to European chemical centers.

M. W. Randall has resigned as secretary of the Air Reduction Co. but will retain his position as vice-president. He will go to California soon as treasurer of the California Cyanide Co.

Henry S. McKee, prominent for more than half a century in the glass industry, died in Atlantic City on June 10. Funeral services were held at his home in New York City last Friday.

A fertilizer exhibition will be held at Shimonoseki, Japan, under the auspices of the Governor of Yumaguchi Ken, during August of this year.

Men You Should Know About

BENNETT R. BATES, manager of the office of the Dorr Co. in Mexico City, with Mrs. Bates, left on June 7 for a 6 months trip in South Africa. Besides spending some time on the Rand, he will visit the sugar district in Natal, where Dorr clarifiers and the Petree process have been extensively introduced.

S. C. BLAYLOCK, general manager of the Consolidated Mining & Smelting Co. of Canada, Trail, B. C., has been awarded the McCharles prize by the board of governors of the University of Toronto, in recognition of his work in connection with the production of electrolytic zinc and with the solution of problems in treating complex lead, silver and zinc ores.

Dr. F. E. BREITHUT, who is expected back in the United States about July 1, as mentioned in this column April 28, will resume his work in the department of chemistry of the College of the City of New York.

J. W. DANIELS, president of the Archer-Daniels-Midland Co., Minneapolis, Minn., has returned after a 3 months trip abroad, during which time he has visited England, France, Holland and Belgium.

H. L. DEBAR has resigned as chief engineer of the refining department of the F. A. Ffeeborn Engineering Corporation, of Tulsa, Okla., to become identified with the process division of the Atlantic Refining Co. in charge of standardizing operations.

JAMES J. FARREL, president of the United States Steel Corporation, New York, made an important address at the opening session of the National Foreign Trade Council, of which he is chairman, at Boston, Mass., June 4, speaking on "Wider Markets for American Products."

CROSBY FIELD, chief engineer of the National Aniline & Chemical Co., has just returned from an extensive trip which took him into nearly every state east of the Mississippi.

H. C. GORE, in charge of the Fruit and Vegetable Utilization Laboratory of the Bureau of Chemistry, resigned on May 24 to accept a position with the Fleischman Yeast Co., New York City. Mr. Gore has been with the Bureau of Chemistry since 1902, when he was made a scientific assistant in investigation in fruit biochemistry and technology.

ALMON G. HOVEY, formerly on the research staff of the Remington Arms Co., Bridgeport, Conn., is now doing research work on insulation for the General Electric Co., Schenectady, N. Y.

C. P. LATHROP, junior chemist of the Food Control Laboratory, has resigned from the Bureau of Chemistry, to accept a position as technical adviser of the National Preservers and Fruit Products Association, with headquarters in Washington.

PAUL B. MORGAN, president of the Morgan Construction Co., Worcester, Mass., has been elected president of the Worcester Gas Light Co., succeeding Louis H. Buckley, deceased.

E. M. ROUBIEU, first vice-president of the Tropenas Co., in charge of its Rio de Janeiro offices, is now on his way to the United States, after an absence of nearly 4 years. He will remain in this country about 6 weeks and then return to South America.

JOHN D. RYAN, chairman of the board of directors of the Anaconda Copper Co., New York, has returned to the city after an absence of 2 months in Europe.

ALEC O. SMITH, sugar engineer, acting as chief engineer at Central Teresa Oriente, Cuba, has returned to his home at New Orleans, La., where he will remain until he returns to Cuba in August.

Dr. DAVID WESSON, chemist and chemical engineer, announces that in addition to remaining technical counselor of the Southern Cotton Oil Co. he is engaging in general consulting practice, with an office at 120 Broadway, New York, N. Y. His laboratory will be located at 111 South Mountain Ave., Montclair, N. J.

C. HAROLD WILLS, metallurgist, president and general manager of Wills Sainte Claire, Inc., Marysville, Mich., has sailed for England, primarily to discuss developments in metallurgy with British scientists in this field.

Calendar

AMERICAN CERAMIC SOCIETY, summer meeting and tour, July 21 to Aug. 18.

AMERICAN ELECTROCHEMICAL SOCIETY, Detroit, Oct. 2 to 4.

AMERICAN ENGINEERING STANDARDS COMMITTEE, executive meeting, New York, July 12.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Denver, Colo., July 15 to 18.

AMERICAN LEATHER CHEMISTS ASSOCIATION, Spring Lake, N. J., June 18 to 20.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, June 23 to 28.

AMERICAN SOCIETY FOR STEEL TREATING, Boston, Sept. 22 to 26.

COLLOID SYMPOSIUM, second national, Northwestern University, Evanston, Ill., June 18 to 21.

INSECTICIDE AND DISINFECTANT MANUFACTURERS ASSOCIATION, Montreal, Canada, June 30 to July 1.

NATIONAL SAFETY COUNCIL, thirteenth annual congress, Louisville, Ky., Sept. 29 to Oct. 3.

NEW JERSEY CLAY WORKERS ASSOCIATION AND EASTERN SECTION AMERICAN CERAMIC SOCIETY, summer meeting, Trenton, N. J., June 20.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, Boulder, Colo., June 25 to 28.

WORLD POWER CONFERENCE, London, June 30 to July 12.

Tropical America Offers Field for Rubber Growing

The Philippines and parts of South and Central America provide regions where the soil and climate are suitable for first-class rubber plantations of practically unlimited area. Certain unfavorable economic and legislative factors must be carefully considered, however, before plantation projects could be started in those regions on a competitive basis with the large areas in the East where 95 per cent of the world's output is now produced.

The foregoing information was submitted to representatives of the American rubber manufacturing industry in conference in New York by Commerce Department investigators who have just returned from explorations and surveys in the Far Eastern and American tropics. Outlining the situation briefly, it was explained that the total area planted in the East was found to be about 4,266,000 acres, of which 2,729,000 acres are owned by European and American capital and 1,537,000 acres by Asiatics. About 3,500,000 acres are producing or old enough to be tapped. Through domicile of plantations in British territory, and through ownership of plantations by British capital in other territory, Great Britain controls 77 per cent of the total area under rubber. American capital invested in the East is estimated at only $32,000,000 against $489,000,000 for Great Britain, $130,000,000 for Holland, $40,000,000 for Japan, $27,000,000 for France and Belgium, and $47,000,000 for other European countries.

Concerning possibilities in the Philippines, the Commerce Department representatives expressed the opinion that the dangers of typhoons and lack of labor supplies, two deterrent factors stressed in previous reports, had been exaggerated. The uncertainty of the present political situation with respect to the Philippines militates considerably against rubber developments in the islands.

Obituary

FREDERIC DAVID ASCHE, vice-president and director of the Standard Oil Co. of New Jersey, New York, died at the local Jewish Memorial Hospital, June 3, as a result of injuries sustained in an automobile accident 3 days previous. He was also president and director of the West India Oil Co., the West India Oil Refining Co. of Cuba, the West India Oil Refining Co. of Delaware and the Standard Oil Co. of Brazil. His wife met her death in the same accident, living only a few hours. Mr. Asche was 51 years of age.

GEORGE GRANT OLIVER, vice-president and general manager of the Hazel-Atlas Glass Co., Wheeling, W. Va., died in a local hospital on June 5, after a critical illness for a month past, aged 68 years. He was graduated from Washington and Jefferson College in 1878 and soon after entered the employ of the Hazel Glass Co., later the Hazel-Atlas Glass Co. He is survived by his wife.

Market Conditions

Market Vatues for Chemical Products Fluctuate But Slightly

Trading Continues Along Moderate Lines—Unseasonable Weather a Factor in Diminishing Call for Some Selections

WHILE there is no sustained buying movement in the market for chemicals and allied products, it is pointed out that price fluctuations are narrow. This is interpreted as an indication that values are around bottom and that further reductions would not be conducive to an expansion in buying.

Many sellers still report a good inquiry for small lots and state that a part of the consuming branch of the industry is working on small supplies of raw materials and is coming in the market regularly for replacement. Some of the basic chemicals have not shared in this improvement in spot trading due to the fact that contract holders of such chemicals are more numerous and consequently there is less need for additional amounts.

The lateness of the season has exerted an influence in restricting consumption of many chemicals. This is very notable in the case of such selections as are used in the manufacture of insecticides, fungicides, etc. Wide publicity has been given to the failure of the calcium arsenate market to reach the point of activity which had been expected but similar conditions are found in the movement of other compounds which find an outlet in agricultural fields and the reaction is apparent in the call for different chemicals.

The weighted index number for the week was fractionally higher mainly under the influence of a stronger market for crude cottonseed oil. There is no decided price tendency in the chemical list and the relatively slow call for stocks keeps prices irregular with buyers still favored.

If statistics of employment may be taken as a basis for computation, the position of the industries which are the largest consumers of chemicals is not improving. Hence a continuance of present conditions seems probable until demand asserts itself more vigorously.

It was announced during the week that the staff for investigating vegetable oils had been completed. It was also stated that lack of funds would prevent the Tariff Commission from investigating all commodities on which applications for changes in tariff had been made. It was not stated whether this would have any effect on chemicals which have been under consideration for tariff revisions.

Acids

The market for the various acids is following in close conformity with the movement of other chemicals. Developments in recent weeks have not been important and in general the market is characterized by a preponderance of stocks and an irregularity of selling prices. With the exception of sulphuric, the export movement of acids has compared unfavorably with that of last year. As the home demand, in most cases, has been light, it is evident that total consumption has been below normal. There were rather heavy arrivals of citric and tartaric acids from abroad last week and spot holdings are reported to have increased, in spite of moderate deliveries to consumers against old orders. Tartaric acid of foreign make has been more of a dominating factor than in previous years, and has found reductions in the home output. Prices for these acids are easy but current prices are held to narrow fluctuations. Boric acid none too steady despite recent declines in price and rumors still prevail about keen competition among producers. Sulphuric and muriatic acid are under selling pressure and stocks are large enough to place buyers in a position of advantage. Nitric acid has been more firmly held with values influenced more by producing costs.

Lead Oxides Reduced Sharply —Caustic Potash Easier—Yellow Prussiate of Potash Lower for Shipment — Copper Sulphate Weak — Arsenic Dull and Under Pressure—Methyl Acetone Easy—Permanganate of Potash Unsettled

Potashes

Bichromate of Potash—According to the values officially given for exports of bichromate of potash in April, the average price was slightly in excess of 9.15c. per lb. This would indicate that sellers were granting concessions to secure export business and reports to that effect are still current. Consumers in this country are not buying freely and reports of curtailed manufacturing operations on the part of the leather, textile and color trades account for the moderate call for bichromate. Prices are still quoted at 9¼@ 9½c. per lb.

Caustic Potash—There was an easier tone in this market. Holders of spot goods were offering rather freely at 6¾c. per lb. Sellers who previously had been asking 7c. per lb. also were meeting the 6¾c. quotation. Shipments from abroad likewise have been more favorable to buyers and there were open quotations at 6¾c. per lb.

Permanganate of Potash—Call for this material has slowed up in recent weeks and sellers have been more eager to attract buyers. The asking price for spot permanganate is held at 14c. per lb. for round lots, but this price might be shaded on firm bids. Forward positions are neglected, with shipments reported at around the same levels as spot goods.

Prussiate of Potash—The firm position of yellow prussiate of potash on spot has been of interest in recent weeks. Call from consumers has not been active, but sellers have held firmly to the quoted prices and 18½c. per lb. appears to have been an inside price. The shipment market was easier in the past week as quotations of 18c. per lb. were heard. Red prussiate also has been steady and 35@38c. per lb. is given as representing the market.

Sodas

Acetate of Soda—Reports of a smaller production have failed to steady prices and sellers appear to be carrying surplus stocks. On round lots 4½c. per lb. can be done with up to 5c. per lb. asked for smaller amounts.

Bichromate of Soda—Scattered buying is reported for prompt delivery and sales of moderate sized lots are said to have been made at 7½c. per lb. at works, and in some cases at delivered points. The movement against contracts has become less steady and reports are heard of postponed deliveries and of reselling contract holdings. However, the market shows no real price weakness and with the exception of export business there are no reports of shading the 7½c. quotation.

Caustic Soda—As far as the domestic trade is concerned the prices openly quoted are being maintained. This is true both on large and small lot business. Demand for jobbing lots is quiet but a fair movement against contracts is still reported. The contract price is largely nominal at present but is repeated at 3.10c. per lb. for carlots, at works. The export situation is rather quiet and the tone of the market was easier last week. This is shown by reports that there were offerings at 2.90c. per lb., f.a.s. New York. There is a difference, however, according to seller and up to 3.05c. per lb., f.a.s. is quoted.

Nitrate of Soda—The limited supply in domestic markets has held prices on a fairly firm basis and $2.55 per 100 lb. is generally asked. Demand has been quiet and nearby positions are quoted considerably under the spot quotation. Stocks afloat also tend to

create an easier feeling and the stringency on spot is not expected to continue for long.

Nitrite of Soda—Some of the prices heard for shipment from foreign ports would make the duty paid price at New York about ½c. per lb. above the spot price. The spot market, however, has not responded and the lack of interest on the part of buyers has brought out some concessions from holders of spot supplies. There were reports that 8¼c. per lb. could be done and 8½c. to 8¾c. per lb. covered the range of asking prices.

Prussiate of Soda—The inside price of sellers of domestic prussiate is said to be 10c. per lb. but there is some doubt about the stability of this figure. The position of imported is more clearly defined, with 9½c. per lb. as the general asking price for spot holdings. Shipments from the other side are quoted at 9½c. per lb. Demand for all positions is quiet.

Miscellaneous Chemicals

Arsenic—Occasional lots of spot arsenic are forced for sale and while these do not truly represent the market, they have an influence in breaking prices. In last week's trading there were reports of sales under 8c. per lb. and the latter figure was said to have been named in different quarters. It was also stated that some domestic producers had lowered their price to 8¼c. per lb. on round lots. Some of the stocks held in the local market are reported to be sold with the buyers asking for deferred deliveries and in a few cases contracts have been repudiated.

Barium Products—Offerings of imported grades have been more numerous and the market has assumed an easier tone. Domestic production has been well taken up and there is no surplus. Imported chloride was quoted at $80@$84 per ton. Carbonate was held at $61@$63 per ton. Nitrate was available at 8¼c. per lb.

Bleaching Powder—The advance of the season has not brought out any weakness in the bleach market. Buying for new account is not heavy but a fair call is reported for contract deliveries. Asking prices remain at $1.90 per 100 lb. for carlots, at works. The contract price for liquid chlorine in tanks is unchanged at 4½c. per lb., at works.

Methyl Acetone — Demand has not been active enough to hold the market in a firm position and rumors of sales at 70c. per gal., in tanks, at works, were given more credence by the fact that some first hands were openly quoting at that figure.

Carbon Tetrachloride—This material has been featured by pressure on the part of sellers and offerings are still plentiful so that the market shows no tendency to harden. Quotations are on a basis of 7@7½c. per lb., according to quantity and seller.

Copper Sulphate — Consumption of copper sulphate in agricultural lines has not yet opened up, the backward season retarding business in this direction. There has been little change in the position of the metal and with offerings of the sulphate fairly large prices

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	152.79
Last week	152.27
June, 1923	177.00
June, 1922	157.00
June, 1921	147.00
June, 1920	274.00
June, 1919	229.00
June, 1918	272.00

Price changes in chemicals were unimportant, but the advance in crude cottonseed was sufficient to raise the index number 52 points.

are unsettled. Domestic producers have been sellers at 5c. per lb., carload lots, delivered to consumers. The works price on domestic was maintained generally at 4.60c. per lb., with intimation that 4.50c. per lb. could be done in some quarters. Imported was offered at 4½c. per lb., f.o.b. New York, immediate delivery, and at 4¼c. per lb., forward delivery.

Formaldehyde—It was reported that less than carload lots sold at 9½c. per lb., indicating that the market was rather easy. Leading makers, however, continue to quote 9½c. on carload lots.

Sal Ammoniac — Demand has been less active and with offerings more numerous, especially on the imported, the undertone continues rather easy. White, imported, spot, available at 6½c., with futures at 6¼c. per lb. Domestic, white, 7½@8c. per lb., and gray at 8@8½c. per lb.

Alcohol

Demand for denatured alcohol was described as fair and with no important change in basic materials prices in most instances held on a steady basis. Most of the buying interest was in the special formulas. Formula No. 1, special, held at 45½c. per gal., drums, carload lots.

Methanol was inactive and the undertone favored buyers. Leading factors maintained the open selling schedule at 75c. per gal. for the 95 per cent grade, in drums, carload lots. Production of methanol has been curtailed.

Coal-Tar Products

No Improvement in Coke Situation—Benzene Firm on Restricted Production—Phenol Irregular—Naphthalene Easy

DEMAND for coal-tar crudes was inactive, but prices, with few exceptions, were steady to firm, reflecting moderate holdings at producing centers. The depression in the coke industry continues, the restricted output naturally affecting the market for coal-tar products. The firmer position of benzene led to no change in the selling basis, and, with the demand subnormal, and rather keen competition with gasoline, most traders expect prices to hold at current levels. Creosote oil has been offered more freely from abroad at lower prices, but the domestic situation underwent no change. Traders have experienced some difficulty in moving stocks of refined naphthalene and prices heard covered a wide range. Cresylic acid was available in a fairly large way and the undertone was barely steady. U.S.P. phenol was irregular, nearby material selling at slight concessions. Aniline oil sold at unchanged prices. The call for intermediates was far from satisfactory.

Aniline Oil and Salt—Business was confined mostly to small lots, but sellers entertained steady views and held prices on the carload basis of 16c. per lb., drums extra. Aniline oil for red was nominal at 40c. per lb. Aniline salt was quiet at 22@23c. per lb.

Benzene—Deliveries against existing contracts absorbed practically the entire production so that surplus stocks remain light. Production is well under that of a year ago, due to the closing down of coke ovens, and this tends to support the market. New business has been disappointing, but traders look for prices to hold firm. The 90 per cent material closed the week at 23c. per gal., and the so-called pure at 25c. per gal., tank car basis, f.o.b. works.

Creosote—Offerings of creosote oil for prompt shipment from the United Kingdom have increased and lower prices prevailed in several quarters. On bulk shipments sellers quote from 7d.@7¼d. per gal., point of production.

Cresylic—Fair business was reported, but offerings were liberal and prices unsettled. Quotations on the 97 per cent grade ranged from 65@70c. per gal. The 95 per cent grade held at 60@65c. per gal. British makers quote 1s. 9d. per gal. on dark goods, Manchester.

Naphthalene—With stocks of refined fairly large the market continues unsettled, scattered lots selling at concessions. Leading makers quote 5@5½c. per lb. on white flake, carload lots, immediate shipment. On forward material the inside figure might be shaded. Chips closed nominally at 4½c. per lb., carload basis. Advices from British producing centers report quiet trading in crude. The market in Manchester on 74-76 melting point crude was nominal at £7 per ton, with 76-78 melting point crude at £8, prompt shipment.

Phenol—While most traders held out for 28c. per lb. on U.S.P. material, immediate delivery, small lots did sell down to 27c. The market was barely steady in some quarters, reflecting slow business. First hands offered nearby phenol at 26c., carload basis, but restricted sales to regular consumers.

Pyridine—Demand was quiet and easier prices prevailed, there being sellers at $4.25@$4.50 per gal., the price depending upon time of delivery.

Paranitraniline—There was no improvement in trading and prices presented an unsettled appearance, ranging from 68@72c. per lb.

Xylene—With the output small traders were able to maintain prices. Business was inactive all week. Commercial xylene held at 28c. per gal., tanks, and 5 degrees at 40c. per gal., tanks, f.o.b. works.

Vegetable Oils and Fats

Sales of Crude Cottonseed at Higher Prices—Nearby Linseed Unsettled—Coconut and China Wood Oils Decline—Greases Steady

IN THE absence of any selling pressure the market for crude and refined cottonseed oil scored moderate gains. Linseed oil for nearby delivery sold at different prices, with the tendency generally downward. China wood oil sold down to new lows for the movement. Several round lots of Ceylon type coconut oil were disposed of at a decline in price. Palm oils were neglected, because of the recent decline in tallow. Oleo stearine was lower, while tallow and greases held on an even basis throughout the week.

Cottonseed Oil—With lard firmer and no improvement in the cotton crop situation selling pressure disappeared and prices for oil moved upward. Crude oil sold at 8⅜@8½c. per lb., tank cars, f.o.b. mills, a net gain of ⅛c. The offerings of old crop crude were scanty and refiners showed buying interest at all times. In the option market speculative shorts were the principal buyers and Thursday witnessed sales of July oil at 10.22c. per lb. Refiners also were buyers of July, while trading in the distant months was mixed in character. The volume of business in the option market was small. Cash trade in oil was described as fair, while lard compound was inactive, dealers complaining of keen competition with pure lard. Less favorable news on grains had a steadying effect on prices for provisions. Bleachable cottonseed oil was scarce and prices were wholly nominal around 9½c. per lb., tank cars, Texas, and 9⅝c. per lb., tank cars, New York, July delivery. Lard compound held at 11⅛@11⅜c. per lb., carload lots, New York. Pure lard, cash, in Chicago, settled on Thursday at 10.40c. per lb., in tierces.

Linseed Oil—There was some buying interest in July oil and several carloads sold on the basis of 90c. per gal., cooperage included. This was not an open quotation, but large buyers experienced no difficulty in locating sellers at this price. There was no call for August forward, the favorable crop news from the Northwest restricting business. Spot oil was nominal so far as prices were concerned, few crushers being in a position to quote on immediate shipment business except on less than carload lots. The asking price on spot for carload lots was 94c. per gal. in bbl. The Duluth market for flaxseed was irregular, closing slightly lower, notwithstanding higher cables from Buenos Aires. Cash seed at Duluth was quoted at $2.35½@$2.37½ per bu. Crushers look for a substantial increase in the flaxseed acreage. News from the flaxseed belt was generally satisfactory. As new crop seed will not be available before September crushers have been forced to take on liberal quantities of Argentine seed, thus lending support to the South American market. Buenos Aires quoted the June option firm at $1.66¼ per bu., which compares with $1.61⅛ per bu. a week ago. Cake for export has steadied, July-August shipment from New York closing at $34 per ton.

China Wood Oil—Selling pressure on the coast forced prices to lower levels. Tank cars actually sold at 11c. per lb., f.o.b. San Francisco, a decline of ⅛c. for the week. There were offerings of tank cars for August forward delivery at 12½c. per lb., f.o.b. New York. Spot oil in this market settled nominally at 13c. per lb. Demand from consumers was slow.

Coconut Oil—It develops that a large soap maker took on about 1,000 tons of Manila oil for future delivery at 7¼c. per lb., bulk basis, c.i.f. Pacific coast ports. Additional offerings at this figure did not come out, sellers asking 7⅜c., bulk basis, coast, up to the close. There were reports of sales of tank cars at 7⅜c., forward delivery, f.o.b. coast, this price obtaining all week. Ceylon type oil in the New York market, nearby positions, held at 8@8¼c. per lb., tank cars, f.o.b. terms. Copra was unchanged at 4⅜c. per lb., c.i.f. Pacific coast.

Smaller Imports of Coconut, Linseed and Palm Oils

Import statistics for the 10 months ended April 30 show a decline in arrivals of coconut, palm and linseed oils. There has been a moderate gain in imports of china wood, edible olive, peanut and rapeseed oils. Imports of oils for the 10 months period, with a comparison, follow:

	1924	1923
China wood, lb..	69,723,620	69,408,922
Coconut, lb....	137,408,291	174,684,745
Olive, edible, lb.	65,981,756	59,260,836
Olive foots, lb. .	*11,883,318	.....
Palm, lb.....	71,394,105	91,127,334
Palm kernel, lb.	*636,324	.....
Peanut, lb.....	9,702,714	3,639,838
Rapeseed, gal..	1,546,665	1,358,086
Linseed, lb....	17,271,987	35,249,660
Soya bean, lb. .	15,724,112	18,495,465
Whale, gal.....	2,274,183	†1,491,839
Other oils (free) lb....	5,801,275	.....

*Beginning Jan. 1, 1924.
†Beginning Sept. 22, 1922.

Corn Oil—Sales of crude corn oil were reported at 8¼c. per lb., tank cars, f.o.b. point of production in the West. The market was steady in sympathy with crude cottonseed.

Olive Oil Foots—Prime green Italian foots on spot offered at 9¼c. per lb. Greek foots nominal at 8⅞@9c. per lb., immediate delivery.

Palm Oils—Lagos on spot offered at 7¼c., with futures nominal at 7.05@7.10c. per lb., c.i.f. basis. Niger nominal at 6⅞c. per lb., all positions. Demand quiet on competition with tallow.

Rapeseed Oil—Refined oil on spot sold at prices ranging from 76@79c. per gal., depending upon the quantity and seller. Market irregular.

Sesame Oil—Cables higher, refined to import closing at 10⅞@11c. per lb.

Soya Bean Oil—Recent business went through at 9⅜c. per lb., duty paid, sellers' tanks, June shipment from Pacific coast. Market steady.

Tallow, Etc.—Extra special tallow sold during the week at 6⅞c. per lb., f.o.b. point of production, the price showing no change with the undertone steady. Yellow grease steady at 6¼@6⅜c. per lb. on good quality. Oleo stearine sold at 9⅛c. per lb., a decline of ⅛c. per lb. Red oil nominal at 8¼@8⅜c. per lb., carload basis.

Miscellaneous Materials

Antimony—The market was a quiet affair, with prices quotably unchanged, Chinese and Japanese closing at 8⅛c. per lb. Cookson's "C" brand nominal at 12¼c. Chinese needle, lump, nominal at 8½@9c. per lb. The imports of regulus, matte and metal for the 10 months ended with April 30 amounted to 18,010,683 lb., which compares with 11,794,538 lb. for the corresponding period a year ago.

Barytes—Water ground floated is steady at $23 per ton, packages included, carload lots, St. Louis. Production curtailed and this tends to support values. Crude offered at $8 per ton, f.o.b. mines, Missouri.

Glycerine—Soap lye crude, basis 80 per cent, sold in the West at 10¼@10½c. per lb., loose, indicating that the market was barely steady. Dynamite glycerine held at 15⅞@16c. per lb., carload lots, in drums, with moderate buying interest in evidence. Chemically pure unchanged at 16½c. per lb., in drums, carload lots, New York.

Naval Stores—Spirits of turpentine declined 1c., the market settling at 84c. per gal. Rosins were steady, the lower grades holding at $5.50 per bbl. Export demand has been better. According to official statistics the exports of spirits of turpentine for the 10 months ending with April 30 amounted to 8,659,753 gal., which compares with 6.600,055 gal. for the corresponding period a year ago.

Shellac—Uncertainty over the fate of a cargo of shellac now afloat firmed up prices. T.N. closed at 54@55c. per lb., with sellers shy. Actual consuming demand, however, showed no improvement. Imports of shellac for the 10 months ended April 30 amounted to 25,363,279 lb., valued at $13,564,586, which compares with 26,115,594 lb., valued at $16,641,313 for the same time last year.

Lead Pigments—Effective June 10 there was a general reduction in prices for red lead, litharge and orange mineral. White lead quotations remained unchanged. The decline in prices was attributed to lower producing costs and keen competition for business. Dry white lead settled at 10½c. per lb., a drop of 1½c. Litharge closed at 10c. per lb., with orange mineral at 13½@14½c. per lb. Standard dry white lead was unchanged at 10½c., with sublimed at 9½c. per lb., in casks or bbl., carload lots. Pig lead was firmer at 7@7⅛c. per lb., depending upon the seller.

Imports at the Port of New York

June 6 to June 12

ACIDS—Boric—200 bg., Leghorn, Pacific Coast Borax Co. **Cresylic**—13 dr., Liverpool, Order. **Citric**—100 bbl., Messina, Order; 200 bbl., Palermo, W. Newberg; 170 csk., Palermo, Order. **Formic** — 128 carboys, Rotterdam, E. Suter & Co. **Stearic**—20 cs., Rotterdam, M. W. Parsons & Plymouth Lab. **Tartaric** — 1,000 csk., Palermo, W. Newberg; 50 csk., Palermo, Order.

ALCOHOL—100 bbl. denatured, Arecibo, Order; 100 bbl. and 25 dr., Arecibo, C. Esteva.

ALUMINUM SILICATE—124 bg., Hull, C. Hardy, Inc.

ANTIMONY—250 bg. crude, Shanghai, Wah Chang Trading Corp.

ANTIMONY REGULUS—700 cs., Shanghai, Wah Chang Trading Corp.

ANTIMONY SULPHIDE — 200 bbl., Havre, Heemsoth, Basse & Co.; 17 csk., Newcastle, E. Hill's Son & Co.

ANTIMONY OXIDE — 150 csk., Newcastle, American-Hawaiian S. S. Co.

ARSENIC — 300 cs., Shanghai, Wah Chang Trading Co.; 117 bbl., Tampico, American Smelting & Refining Co.; 99 bbl., Antwerp, Chemical National Bank; 800 cs. (at San Francisco), Kobe, Order.

BARIUM BINOXIDE — 62 cylinders, Havre, A. Lusskin & Co.

BARIUM CHLORIDE—56 csk., Rotterdam, T. Goldschmidt Co.

BARYTES—250 bg., Bremen, New York Trust Co.; 1 lot (in bulk), Bremen, Ore & Chemical Corp.; 200 bg., Hamburg, Cooper & Cooper; 350 bg., Bremen, New York Trust Co.

BORACITE—1,000 tons (in bulk), Panderma, Pacific Coast Borax Co.

BRONZE POWDER — 20 cs., Bremen, Gerstendorfer Bros.; 17 cs., Bremen, Order; 18 cs., Bremen, B. F. Drakenfeld & Co.; 18 cs., Bremen, Bank of the Manhattan Co.

BUTYL ACETATE—7 pkg. Rotterdam, H. A. Metz & Co.

CASEIN—417 bg., Buenos Aires, Virginia Pulp & Paper Co.; 417 bg., Buenos Aires, International Acceptance Bank; 2,915 bg., Buenos Aires, Order; 2,083 bg., Buenos Aires, Kalbfleisch Corp.; 150 bg., Bordeaux, T. M. Duche & Sons.

CALCIUM CARBIDE—920 dr., Rotterdam, F. C. Caffey.

CHALK — 1 lot (in bulk), Dunkirk, Taintor Trading Co.; 100 bg., London, Brown Bros. & Co.

CHEMICALS—8 bbl., Havre, Wallerstein Laboratory; 185 csk., Rotterdam, Roessler & Hasslacher Chemical Co.; 375 csk., Rotterdam, Chemical National Bank; 20 cs., Hamburg, E. Dietzgen & Co.; 5 csk., Bremen, Hummel & Robinson; 336 bg., Glasgow, Brown Bros. & Co.; 280 bg., Glasgow, Coal & Iron National Bank; 10 dr., London, Order; 13 cs., London, Merck & Co.

CHINA CLAY—200 tons blue, Bristol, Moore & Munger.

CHROMIUM OXIDE—1 bbl. hydrate, Hamburg, Toch Bros.

COAL-TAR DISTILLATE — 171 dr., Liverpool, Order.

COLORS—4 cs. aniline, Genoa, Mechanics & Metals National Bank; 11 pkg., Southampton, American Exchange National Bank; 7 csk. aniline, Rotterdam, Kuttroff, Pickhardt & Co.; 27 pkg. do., Rotterdam, H. A. Metz & Co.; 5 csk. do., Rotterdam, A. H. Mayer; 7 csk. do., Rotterdam, Carbic Color & Chemical Co.; 10 pkg. do., Rotterdam, Grasselli Chemical Co.; 2 csk., Hamburg, G. Seigle Corp.; 4 pkg. aniline, Hamburg, Franklin Import & Export Co.; 1 cs. do., Hamburg, A. Hurst & Co.; 10 csk. do., Hamburg, Order; 6 pkg. aniline, Havre, Sandoz Chemical Works; 1 csk. do., Havre, Carbic Color & Chemical Co.; 1 csk. do., Genoa, Bank of the Manhattan Co.; 22 dr., aniline, Buenos Aires, National Aniline & Chemical Co.; 20 cs. dry, London, R. F. Downing & Co.; 2 bbl. aniline, Antwerp, Order; 10 cs., Southampton, American Exchange National Bank.

COPPER OXIDE — 16 bbl., London, Order.

CUTCH—200 bg., Calcutta, Order.

DIVI-DIVI—225 bg., Maracaibo, Standard Bank of South Africa; 561 bg., Pampatar, Eggers & Heinlein.

EPSOM SALT — 250 bg., Bremen, E. Suter & Co.

FLUORSPAR—251,550 kilos, Rotterdam, Winter, Wolff & Co.

GAMBIER—154 bg., Singapore, Order.

GLAUBER SALT — 230 csk., Bremen, Globe Shipping Co.

GLYCERINE—45 dr. crude, Marseilles, Order.

GUMS—200 bg. arabic, Port Sudan, Orbis Products Co.; 313 bg. do., Port Sudan, Order; 210 bg. copal, Antwerp, W. Schall & Co.; 476 bg. do., Antwerp, Order; 68 bg. do., Antwerp, Order; 180 pkg. copal, Manila, Chartered Bank of India, Australia & China; 200 cs. damar and 75 cs. copal, Singapore, Brown Bros. & Co.; 150 cs. damar, Singapore, Order; 100 cs. damar, Singapore, National Bank of New York; 140 bg. copal, Singapore, Standard Bank of South Africa; 140 bg. do., Singapore, Baring Bros. & Co.; 64 bg. do., Singapore, Order; 374 bg. copal, Antwerp, Chemical National Bank.

IRON OXIDE—11 csk., Marseilles, C. F. Gledkin & Co.; 39 csk., Bristol, Reichard-Coulston, Inc.; 26 csk., Liverpool, Reichard-Coulston, Inc.; 10 csk., Liverpool, L. H. Butcher, Inc.; 71 csk., Liverpool, J. A. McNulty; 21 csk., Liverpool, R. J. Waddell & Co.; 25 csk., Liverpool, Order.

IRON POWDER—12 cs., Bremen, Mallinckrodt Chemical Works.

MAGNESIUM CARBONATE — 22 csk., Newcastle, De Mattia Chemical Co.; 515 bg., Newcastle, Order; 30 cs., Newcastle, Order.

MAGNESIUM CITRATE — 40 pkg., Genoa, Order.

MAGNESITE—125 bg., Rotterdam, A. Kramer & Co.; 313 bg. and 113 csk., Rotterdam, Speiden, Whitfield Co.; 248 csk., Rotterdam, Brown Bros. & Co.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

ACIDS, SODAS, ETC. Cairo, Egypt. Agency.—10,482.

CHEMICALS, especially for the ceramic industry. Rio de Janeiro, Brazil. Agency.—10,490.

CHEMICALS, HEAVY. Hamburg, Germany. Agency.—10,474.

CHEMICALS, HEAVY. Hamburg, Germany. Purchase.—10,485.

CHEMICALS, HEAVY, solvents, and wax. Hamburg, Germany. Purchase.—10,524.

CHEMICALS, INDUSTRIAL. Paris, France. Purchase.—10,486.

CHEMICALS AND DYES. São Paulo, Brazil. Agency.—10,527.

COLOR AND PAINTS for cement and waterproofing compounds. Lisbon, Portugal. Purchase and agency.—10,502.

MINERALS, pigments and red lead. Malmo, Sweden. Purchase.—10,523.

PAINTS AND VARNISHES. Cairo, Egypt. Agency.—10,482.

PAINT AND VARNISH REMOVER. Palermo, Italy. Purchase and agency.—10,526.

ROSIN. 25 to 50 tons. Malmo, Sweden. Purchase and agency.—10,526.

SODA, CAUSTIC. Amritsar, India. Purchase.—10,486.

SODA, CAUSTIC. São Paulo, Brazil. Agency.—10,493.

MANGROVE BARK — 14 bg., Monte Christi, National Shawmut Bank.

MINERAL WHITE — 1,200 bg., Hull, Hammil & Gillespie; 100 bg., Hull, Whittaker, Clarke & Daniels.

MYROBALANS — 603 bg., Calcutta, Order.

OCHER—19 csk., Marseilles, J. L. Smith & Co.; 59 csk., Marseilles, Reichard-Coulston, Inc.; 316 csk., Marseilles, Gallagher & Ascher; 263 csk., Marseilles, Order.

OILS—China Wood—150 csk., Shanghai, A. Klipstein & Co.; 300 bbl., Shanghai, L. C. Gillespie & Sons. **Cod**—100 bbl., Hull, Order; 200 bbl., Aberdeen, Bankers Trust Co. **Coconut**—750 tons (in bulk), Manila, G. Pierce Mfg. Co. **Linseed**—125 dr., Rotterdam, Order. **Olive Foots** (sulphur oil)—100 bbl., Leghorn, Bank of the Manhattan Co. **Palm**—60 dr., Belawan, V. E. Sezen; 23 csk., Liverpool, Welch, Holme & Clark Co. **Sesame**—400 bbl., Rotterdam, Fontana Bros., Inc.; 100 bbl., Rotterdam, Aspegren & Co.; 15 csk., Havre, American Express Co.

OIL SEEDS—Copra—618 bg., Trinidad, Order; 54 bg., Cristobal, Franklin Baker Co.; 488 bg., Port Morant, Powdrell Importing Co. **Castor**—1,493 bg., Calcutta, Order. **Linseed**—17,362 bg., Buenos Aires, L. Dreyfus & Co.; 16,949 bg., Buenos Aires, Order; 81,877 bg., Santa Fe, Spencer Kellogg & Sons; 22,237 bg., Buenos Aires, Bingham & Co.

PLUMBAGO—74 bbl., Colombo, Order; 50 bbl., Colombo, Bank of New York; 4 bbl., London, Order.

POTASSIUM SALTS — 20 csk. oxalate, Rotterdam, Hummel & Robinson; 330 dr. caustic, Hamburg, H. Hollesen, Inc.; 2,500 bg. muriate, 1,000 bg. sulphate and 1,000 bg. manure salt, Bremen, Potash Importing Corp. of America.

PUMICE—135 bg. and 30 bbl., Canneto Lipari, C. B. Richard & Co.; 4,105 bg., 10 csk. and 175 bg. powdered, Canneto Lipari, Gallagher & Ascher.

QUEBRACHO—4,261 bg., Buenos Aires, Order; 2,002 bg., Buenos Aires, Guaranty Trust Co.; 974 bg., Buenos Aires, International Products Co.; 15,457 bg., Buenos Aires, Tannin Corp.

QUICKSILVER — 100 flasks, Genoa, Order.

SAL AMMONIAC — 41 csk., Hamburg, Order.

SHELLAC—2,374 pkg., Calcutta, Order; 129 bg., Marseilles, Order; 56 cs., Singapore, Brown Bros. & Co.; 168 cs., Singapore, Order; 75 bg., Hamburg, Ralli Bros.; 5 cs., Hamburg, Rogers, Pyatt Shellac Co.; 30 cs., Hamburg, Order; 165 bg., Saigon, Eastern Banking Corp.; 5 bg., Havre, Rogers, Pyatt Shellac Co.; 50 chests, London, Order.

SIENNA—25 csk., Leghorn, J. Lee Smith & Co.; 100 bg., Leghorn, Reichard-Coulston, Inc.; 75 bbl., Leghorn, R. J. Waddell & Co.; 176 bbl., Leghorn, Order.

SILVER SULPHIDE—8 cs., Central Pacific Ports, Goldsmith & Co.

SODIUM SALTS—15 csk. prussiate, Rotterdam, Order; 100 csk. hyposulphite, Hamburg, Order; 169 dr., cyanide, Liverpool, Order.

SUMAC—700 bg., Palermo, New York Trust Co.

TALLOW—150 tcs., Vancouver, Order.

TANNING EXTRACT—50 cs., Liverpool, Brown Bros. & Co.

TARTAR—105 bg., Marseilles, C. Pfizer & Co.; 250 bg., Naples, Royal Baking Powder Co.; 668 bg., Buenos Aires, C. Pfizer & Co.; 48 csk., Leghorn, Royal Baking Powder Co.; 70 csk., Naples, Tartar Chemical Works.

ULTRAMARINE BLUE—11 csk., Antwerp, Reichard-Coulston, Inc.

UMBER—284 bg. calcined, Larnaca, J. Lee Smith & Co.; 3,012 bg., Larnaca, Order.

VERMILION — 4 bbl., Bremen, A. J. Stauff & Co.

WAXES—125 cs. vegetable, Kobe, National City Bank; 384 blocks ozokerite, Bremen, J. Dick; 30 bl. bleached beeswax, Rotterdam, Ponds Extract Co.; 100 bg. beeswax, Hamburg, W. Schall & Co.; 35 bg. do., Hamburg, National City Bank; 60 bg. mineral, Hamburg, L. S. Tainter; 4 bg. beeswax, San Juan, Order; 16 bg. carnauba and 34 bg. beeswax, Rio de Janeiro, American Trading Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks.	lb.	$0.13 –	$0.15½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.09 –	.09½
Citric, kegs	lb.	.47 –	.48
Formic, 85%	lb.	.12½ –	.13
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½ –	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½ –	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.09½ –	.10
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	10.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	14.00 –	15.00
Sulphuric, 66° drums	ton	18.00 –	19.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.28
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.25 –	.30
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.83 –	....
Ethyl, 190 p'f, U.S.P., bbl.	gal.	4.81 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½ –	...
No. 1, 190 proof, special, dr.	gal.	.45½ –	...
No. 1, 188 proof, bbl.	gal.	.52½ –	...
No. 1, 188 proof, dr.	gal.	.48½ –	...
No. 5, 188 proof, bbl.	gal.	.50½ –	...
No. 5, 188 proof, dr.	gal.	.44½ –	...
Alum, ammonia, lump, bbl.	lb.	.03½ –	.04
Potash, lump, bbl.	lb.	.02½ –	.03½
Chrome, lump, potash, bbl.	lb.	.05½ –	.06
Aluminum sulphate, com., bags	100 lb.	1.35 –	1.40
Iron free bags	lb.	2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½ –	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12 –	.13
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.00 –	3.25
Antimony oxide, white, bbl.	lb.	.09½ –	.10
Arsenic, white, powd., bbl.	lb.	.08½ –	.08¾
Arsenic, red, powd., kegs	lb.	.14½ –	.15½
Barium carbonate, bbl.	ton	61.00 –	66.00
Barium chloride, bbl.	ton	82.00 –	88.00
Barium dioxide, 88%, drums	lb.	.17½ –	.18
Barium nitrate, casks	...	.08½ –	.08¾
Blanc fixe, dry, bbl.	lb.	.03½ –	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.20 –	2.25
Borax, bbl.	lb.	.05 –	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	3.00 –	3.05
Calcium arsenate, dr.	lb.	.10 –	.10½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½ –	.07½
Camphor, Jap. cases	lb.	.73 –	.73½
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.07 –	.07½
Chalk, precip.—domestic, light, bbl.	lb.	.04½ –	.04½
Domestic, heavy, bbl.	lb.	.03½ –	.04
Imported, light, bbl.	lb.	.04½ –	.05
Chlorine, liquid, tanks, wks.	lb.	.04½ –	....
Contract, tanks, wks.	lb.	.04½ –	....
Cylinders, 100 lb., wks.	lb.	.05½ –	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 –	18.00
Copper carbonate, bbl.	lb.	.15½ –	.16
Copper cyanide, drums	lb.	.45 –	.46
Coppersulphate, dom., bbl.	100 lb.	4.50 –	4.65
Imp bbl.	100 lb.	4.25 –	....
Cream of tartar, bbl.	lb.	.20½ –	.21
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.15 –	1.25
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.10 –	2.35
Ether, U.S.P., dr.	lb.	.14 –	.15
Ethyl acetate, 85%, drums	gal.	.92 –	.95
Ethyl acetate, 99%, dr.	gal.	$1.08 –	$1.10
Formaldehyde, 40%, bbl.	lb.	.09½ –	.09¾
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	3.25 –	4.00
Fusel oil, crude, drums	gal.	2.50 –	2.75
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.16½ –	.16¾
Glycerine, dynamite, drums	lb.	.15½ –	.16
Glycerine, crude 80%, loose	lb.	.10½ –	.10¾
Hexamethylene, drums	lb.	.65 –	.75
Lead:			
White, basic carbonate, dry, casks	lb.	.10½ –	....
White, basic sulphate, casks	lb.	.09½ –	....
White, in oil, kegs	lb.	.12½ –	....
Red, dry, casks	lb.	.10½ –	....
Red, in oil, kegs	lb.	.12½ –	....
Lead acetate, white crys., bbl.	lb.	.14½ –	....
Brown, broken, casks	lb.	.13½ –	....
Lead arsenate, powd., bbl.	lb.	.16 –	.18
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10 –	.10½
Lithopone, bags	lb.	.06½ –	.06¾
Magnesium carb., tech., bags	lb.	.08½ –	.08¾
Methanol, 95%, bbl.	gal.	.80 –	....
Methanol, 97%, bbl.	gal.	.82 –	....
Methanol, pure, tanks	gal.	.80 –	....
drums	gal.	.82 –	....
bbl.	gal.	.87 –	....
Methyl-acetone, t'ks.	gal.	.70 –	.75
Nickel salt, double, bbl.	lb.	.09½ –	.10½
Nickel salts, single, bbl.	lb.	.10 –	.11
Orange mineral, csk.	lb.	.13½ –	.14½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½ –	.09¾
Potassium bromide, gran., bbl.	lb.	.22 –	.38
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½ –	.05¾
Potassium chlorate, powd.	lb.	.07½ –	.08¼
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.07½ –	.08
Potassium hydroxide (caustic potash) drums	lb.	.06½ –	.06¾
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06 –	.07½
Potassium permanganate, drums	lb.	.14 –	.14½
Potassium prussiate, red, casks	lb.	.35 –	.38
Potassium prussiate, yellow, casks	lb.	.18½ –	.18½
Salammoniac, white, gran., casks, imported	lb.	.06½ –	.06¾
Salammoniac, white, gran., bbl., domestic	lb.	.07–¼	.07½
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk) works	ton	18.00 –	20.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	2.90 –	3.05
Sodium acetate, works, bbl.	lb.	.04½ –	.05
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½ –	.07½
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite powd., U.S.P., bbl.	lb.	.04½ –	.04½
Sodium chlorate, kegs	lb.	.06½ –	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½ –	$0.10
Sodium hyposulphite, bbl.	lb.	.02½ –	.02¾
Sodium nitrite, casks	lb.	.08½ –	.08¾
Sodium peroxide, powd., cases	lb.	.25 –	.28
Sodium phosphate, dibasic, bbl.	lb.	.03½ –	.03¾
Sodium prussiate, yel. bbl.	lb.	.09½ –	.10½
Sodium salicylic, drums	lb.	.38 –	.40
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½ –	.03¾
Sodium sulphite, crys., bbl.	lb.	.02½ –	.03
Strontium nitrate, powd., bbl.	lb.	.10 –	.10½
Sulphur chloride, yel drums	lb.	.04½ –	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.12 –	....
Tin oxide, bbl.	lb.	.48 –	....
Tin crystals, bbl.	lb.	.31½ –	....
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.05 –	.05½
Zinc cyanide, drums	lb.	.36½ –	.37
Zinc dust, bbl	lb.	.08 –	.08½
Zinc oxide, lead free, bag	lb.	.07½ –	....
5% lead sulphate, bags	lb.	.07½ –	....
10 to 35 % lead sulphate, bags	lb.	.07 –	....
French, red seal, bags	lb.	.09½ –	....
French, green seal, bags	lb.	.10½ –	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.75 –	.80
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salt, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	....
f.f.c. drums	lb.	1.60 –	....
tech., drums	lb.	68	.72
Benzene, pure, water-white, tanks, works	gal.	.25 –	....
Benzene, 90%, tanks, works	gal.	.23 –	....
Benzidine base, bbl.	lb.	.80 –	.82
Benzidine sulphate, bbl.	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.82 –	.85
Benzoate of soda, U.S.P., bbl.	lb.	.65 –	.70
Benzyl chloride, 95-97%, ref., carboys	lb.	.35 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresol, U.S.P., drums	lb.	.22 –	.26
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.65 –	.70
95-97%, drums, works	gal.	.60 –	.65
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.55 –	....
Dimethylaniline, drums	lb.	.36 –	.38
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
Diphenylamine, bbl.	lb.	.48 –	.50
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.05 –	.05½
Naphthalene, balls, bbl.	lb.	.06 –	.06½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.25 –	.30
Nitro-toluene, drums	lb.	.13½ –	.14
N-W acid, bbl.	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.12 –	.13
Ortho-nitrophenol, bbl.	lb.	1.25 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.13 –	.14
Para-ammophenol, base, kegs	lb.	1.20 –	1.25
Para-aminophenol, HCl, kegs	lb.	1.30 –	1.40
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.58 –	.60
Para-phenylenediamine, bbl.	lb.	1.40 –	1.50
Para-toluidine, bbl	lb.	.72 –	.80
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.28
Picric acid, bbl.	lb.	.20 –	.22
Pitch, tanks, works	ton	25.00 –	30.00
Pyridine, imp., drums	gal.	4.65 –	4.85
Resorcinol, tech., kegs	lb.	1.30 –	1.40

Resorcinol, pure, kegs	lb.	$1.90 – $2.00
R-salt, bbl.	lb.	.55 – .60
Salicylic acid, tech., bbl.	lb.	.31 – .32
Salicylic acid, U.S.P., bbl.	lb.	.35 – ..
Solvent naphtha, water-white, tanks	gal.	.25 – ....
Crude, tanks	gal.	.22 – ....
Sulphanilic acid, crude, bbl.	lb.	.16 – .18
Toluidine, bbl	lb.	1.00 – 1.05
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars, works	gal.	.26 – ....
Toluene, drums, works	gal.	.30 – ....
Xylidine, drums	lb.	.48 – .50
Xylene, 5 deg.-tanks	gal.	.40 – ....
Xylene, com., tanks	gal.	.28 – ....

Naval Stores

Rosin B-D, bbl. 280 lb.		$5.50 – $5.55
Rosin E-I, bbl. 280 lb.		5.65 – 5.70
Rosin K-N, bbl. 280 lb.		5.90 – 6.10
Rosin W.G.-W.W., bbl. 280 lb.		7.00 – 7.60
Wood rosin, bbl. 280 lb.		5.40 – 5.50
Turpentine, spirits of, bbl.	gal.	.84 – .85
Wood, steam dist., bbl.	gal.	.75 – .76
Wood, dest. dist., bbl.	gal.	.58 – .60
Pine tar pitch, bbl. 200 lb.		5.50 – .....
Tar, kiln burned, bbl. 500 lb.		10.50 – .....
Retort tar, bbl. 500 lb.		10.50 – .....
Rosin oil, first run, bbl.	gal.	.40 – .....
Rosin oil, second run, bbl.	gal.	.45 – .....
Rosin oil, third run, bbl.	gal.	.50 – .....
Pine oil, steam dist.	gal.	.60 – .....
Pine tar oil, com'l.	gal.	.30 – .....

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ – $0.05½
Grease, yellow, loose	lb.	.06½ – .06½
Lard oil, Extra No. 1, bbl.	gal.	.85 – .....
Lard compound, bbl.	lb.	.11½ – .11½
Neatsfoot oil 20 deg. bbl.	gal.	1.26 – .....
No. 1 bbl.	gal.	.86 – .88
Oleo Stearine	lb.	.09½ – .09½
Oleo oil, No. 1, bbl.	lb.	.12½ – .12½
Red oil distilled, d.p. bbl.	lb.	.08½ – .09
Saponified bbl.	lb.	.08½ – .09
Tallow, extra, loose works	lb.	.06½ – .....
Tallow oil, acidless, bbl.	gal.	.82 – .....

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.15 – .....
Castor oil, No. 1, bbl.	lb.	.15½ – .....
Chinawood oil, bbl.	lb.	.13 – .13½
Coconut oil, Ceylon, bbl.	lb.	.09½ – .09½
Ceylon, tanks, N.Y.	lb.	.08 – .08½
Coconut oil, Cochin, bbl.	lb.	.09½ – .....
Corn oil, crude, bbl.	lb.	.10 – .10½
Crude, tanks, (f.o.b. mill)	lb.	.08½ – .....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½ – .08½
Summer yellow, bbl.	lb.	.10½ – .10½
Winter yellow, bbl.	lb.	.11½ – .11½
Linseed oil, raw, car lots, bbl.	gal.	.94 – .....
Raw, tank cars (dom.)	gal.	.88 – .....
Boiled, cars, bbl. (dom.)	gal.	.96 – .....
Olive oil, denatured, bbl.	gal.	1.20 – 1.25
Sulphur, (foots) bbl.	lb.	.08½ – .09½
Palm, Lagos, casks	lb.	.07½ – .....
Niger, casks	lb.	.06½ – .06½
Palm kernel, bbl.	lb.	.09 – .09½
Peanut oil, crude, tanks (mill)	lb.	.11 – .....
Peanut oil, refined, bbl.	lb.	.14½ – .14½
Perilla, bbl	lb.	.14 – .14½
Rapeseed oil, refined, bbl.	gal.	.76 – .77
Sesame, bbl.	lb.	.10½ – .11½
Soya bean (Manchurian), bbl.	lb.	.11½ – .11½
Tank, f.o.b. Pacific coast	lb.	.09½ – .10
Tank, (f.o.b. N.Y.)	lb.	.10½ – ....

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.60 – $0.62
Menhaden, light pressed, bbl.	gal.	.56 – .....
White bleached, bbl.	gal.	.58 – .....
Blown, bbl.	gal.	.62 – .....
Crude, tanks (f.o.b. factory)	gal.	.47½ – .50
Whale No. 1 crude, tanks, coast	lb.	..... – .....
Winter, natural, bbl.	gal.	.75 – .76
Winter, bleached, bbl.	gal.	.78 – .79

Oil Cake and Meal

Coconut cake, bags	ton	$28.00 – 29.00
Cottonseed meal, f.o.b. mills	ton	36.00 – 37.00
Linseed cake, bags	ton	33.50 – 34.00
Linseed meal, bags, spot	ton	39.00 – 41.00

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.50 – $0.55
Albumen, egg, tech, kegs	lb.	.95 – .97
Cochineal, bags	lb.	.32 – .34
Cutch, Borneo, bales	lb.	.04½ – .04½
Cutch, Rangoon, bales	lb.	.13½ – .14½
Dextrine, corn, bags 100 lb.		3.09 – 3.64
Dextrine, gum, bags 100 lb.		3.99 – 4.09
Divi-divi, bags	ton	40.00 – 42.00
Fustic, sticks	ton	30.00 – 35.00
Fustic, chips, bags	lb.	.04 – .05
Gambier com., bags	lb.	.11½ – .12½
Logwood, sticks	ton	25.00 – 26.00
Logwood, chips, bags	lb.	.02½ – .03
Sumac, leaves, Sicily, bags	ton	..... – .....
Sumac, ground, bags	ton	160.00 – 170.00
Sumac, domestic, bags	ton	50.00 – 55.00
Starch, corn, bags 100 lb.		3.07 – 3.82
Tapioca flour, bags	lb.	.05½ – .06½

Extracts

Archil, conc., bbl.	lb.	$0.16½ – $0.20
Chestnut, 25% tannin, tanks	lb.	.01½ – .02½
Divi-divi, 25% tannin, bbl.	lb.	.04 – .05
Fustic, crystals, bbl.	lb.	.20 – .22
Fustic, liquid, 42°, bbl.	lb.	.08 – .09
Gambier, liq., 25% tannin, bbl.	lb.	.09½ – .10
Hematine crys., bbl.	lb.	.14 – .18
Hemlock, 25% tannin, bbl.	lb.	.03½ – .04
Hypernic, solid, drums	lb.	.24 – .26
Hypernic, liquid, 51°, bbl.	lb.	.09½ – .10½
Logwood, crys., bbl.	lb.	.14 – .15
Logwood, liq., 51°, bbl.	lb.	.08 – .09
Osage Orange, 51°, liquid, bbl.	lb.	.07 – .08
Osage Orange, powder, bg.	lb.	.14 – .15
Quebracho, solid, 65% tannin, bbl.	lb.	.05 – .05½
Sumac, dom., 51°, bbl.	lb.	.07 – .07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 – $0.11
spot, cases	lb.	.12 – .16
Lampblack, bbl.	lb.	.12 – .40
Mineral, bulk	ton	35.00 – 45.00
Blues–Bronze, bbl.	lb.	.38 – .40
Prussian, bbl.	lb.	.38 – .40
Ultramarine, bbl.	lb.	.08 – .35
Browns, Sienna, Ital., bbl.	lb.	.06 – .14
Sienna, Domestic, bbl.	lb.	.03½ – .04
Umber, Turkey, bbl.	lb.	.04 – .04½
Greens–Chrome, C.P. Light, bbl.	lb.	.28 – .30
Chrome, commercial, bbl.	lb.	.11½ – .12
Paris, bulk	lb.	.24 – .26
Reds, Carmine No. 40, tins	lb.	4.25 – 4.50
Iron oxide red, casks	lb.	.08 – .12
Para toner, kegs	lb.	.95 – 1.00
Vermilion, English, bbl.	lb.	1.35 – 1.40
Yellow, Chrome, C.P. bbls.	lb.	.17½ – .18
Ocher, French, casks	lb.	.02½ – .03

Waxes

Bayberry, bbl.	lb.	$0.21 – $0.21½
Beeswax, crude, Afr. bg.	lb.	.25 – .26
Beeswax, refined, light, bags	lb.	.32 – .34
Beeswax, pure white, cases	lb.	.40 – .41
Candellila, bags	lb.	.23 – .23½
Carnauba, No. 1, bags	lb.	.39 – .40
No. 2, North Country, bags	lb.	.29 – .30
No. 3, North Country, bags	lb.	.22 – .23
Japan, cases	lb.	.23 – .23½
Montan, crude, bags	lb.	.05½ – .06
Paraffine, crude, match, 105-110 m.p., bbl.	lb.	.05½ – ....
Crude, scale 124-126 m.p. bags	lb.	.04½ – .04½
Ref., 118-120 m.p., bags	lb.	.05 – .05½
Ref., 123-125 m.p., bags	lb.	.05½ – ....
Ref, 128-130 m.p., bags	lb.	.05½ – .05½
Ref., 133-135 m.p., bags	lb.	.06 – ....
Ref., 135-137 m.p., bags	lb.	.06½ – .07
Stearic acid, sgle pressed, bags	lb.	.10½ – ....
Double pressed, bags	lb.	.11 – ....
Triple pressed, bags	lb.	.12½ – ....

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 – $7.75
Ammonium sulphate, bulk f.o.b. works 100 lb.		2.60 – .....
Blood, dried, bulk	unit	4.10 – 4.15
Bone, raw, 3 and 50, ground	ton	26.00 – 28.00
Fish scrap, dom., dried, wks.	unit	..... – .....
Nitrate of soda, bags 100 lb.		2.60 – .....
Tankage, high grade, f.o.b. Chicago	unit	2.20 – .....
Phosphate rock, f.o.b. mines		
Florida pebble, 68-72%.	ton	3.25 – 3.70
Tennessee, 75%.	ton	6.75 – 7.00
Potassium muriate, 80%, bags	ton	34.55 – .....
Potassium sulphate, bags basis 90%.	ton	45.85 – .....
Double manure salt	ton	26.35 – .....
Kainit	ton	7.22 – .....

Crude Rubber

Para—Upriver fine	lb.	$0.20 – .....
Upriver coarse	lb.	.14½ – .....
Upriver caucho ball	lb.	.14½ – .....
Plantation—First latex crepe	lb.	.19½ – .20
Ribbed smoked sheets	lb.	.19½ – .....
Amber crepe No. 1	lb.	.19½ – .....

Gums

Copal, Congo, amber, bags	lb.	$0.09 – $0.14
East Indian, bold, bags	lb.	.14 – .15
Manila, pale, bags	lb.	.18 – .19
Pontinak, No. 1 bags	lb.	.19 – .20
Damar, Batavia, cases	lb.	.22½ – .23
Singapore, No. 1, cases	lb.	.27 – .27½
Singapore, No. 2, cases	lb.	.18½ – .19
Kauri, No. 1, cases	lb	.58 – .64
Ordinary chips, cases	lb.	.21 – .22
Manjak, Barbados, bags	lb.	.06 – .09

Shellac

Shellac, orange fine, bags	lb.	$0.56 – $0.57
Orange superfine, bags	lb.	.58 – .....
A. C. garnet, bags	lb.	.52 – .....
Bleached, bonedry	lb.	.65 – .....
Bleached, fresh	lb.	.54 – .55
T. N., bags	lb.	.54 – .55

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec sh. ton		$300.00 – $400.00
Asbestos, shingle, f.o.b., Quebec sh. ton		50.00 – 70.00
Asbestos, cement, f.o.b., Quebec sh. ton		20.00 – 25.00
Barytes, grd, white, f.o.b. mills, bbl. net ton		16.00 – 17.00
Barytes, grd., off-color, f.o.b. Balt. net ton		13.00 – 14.00
Barytes, floated, f.o.b. St. Louis, bbl. net ton		23.00 – 24.00
Barytes, crude f.o.b. mines, bulk net ton		8.00 – 8.50
Casein, bbl., tech. lb.		.10½ – .12
China clay (kaolin) crude, No. 1, f.o.b. Ga. net ton		7.00 – 8.00
Washed, f.o.b. Ga. net ton		8.50 – 9.00
Powd., f.o.b. Ga. net ton		14.00 – 20.00
Crude f.o.b. Va. net ton		6.00 – 8.00
Ground, f.o.b. Va. net ton		13.00 – 19.00
Imp., lump, bulk net ton		15.00 – 20.00
Imp., powd. net ton		45.00 – 50.00
Feldspar, No. 1 f.o.b. N.C. long ton		7.00 – 7.50
No. 2 f.o.b. N.C. long ton		4.50 – 5.00
No. 1 soap long ton		6.75 – 7.00
No. 1 Canadian, f.o.b. mill, powd. long ton		20.00 – .....
Graphite, Ceylon, lump, first quality, bbl. lb.		.05½ – .06
Ceylon, chip, bbl. lb.		.04½ – .05
High grade amorphous crude ton		15.00 – 35.00
Gum arabic, amber, sorts, bags lb.		.12½ – .13
Gum tragacanth, sorts, bags lb.		.48 – .50
No. 1, bags lb.		1 20 – .....
Kieselguhr, f.o.b. Cal. ton		40 00 – 42.00
F.o.b. N. Y. ton		50.00 – 55 00
Magnesite, calcined, f.o.b. Cal. ton		35.00 – 45 00
Pumice stone, imp., casks lb.		.03 – .40
Dom., lump, bbl. lb.		.06 – .08
Dom., ground, bbl. lb.		.03 – 05
Silica, glass sand, f.o.b. Ind. ton		2.00 – 2.50
Silica, sand blast, f.o.b. Ind. ton		2.25 3.50
Silica, amorphous, 200-mesh, f.o.b. Ill. ton		20.00 – .....
Silica, glass sand, f.o.b. Ill. ton		2.00 – 2.50
Soapstone, coarse, f.o.b. Vt., bags ton		7.50 – 8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra ton		10.50 – .....
Talc, 200 mesh, f.o.b. Ga., bags ton		8.00 – 10.00
Talc, 325 mesh, f.o.b. New York, grade A bags ton		14.75 – .....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.75 – $4.25
Corning	bbl.	2.15 – ....
Cabell	bbl.	1.95 – ....
Somerset	bbl.	2.05 – 2.25
Illinois	bbl.	2.07 – ....
Indiana	bbl.	2.08 – ....
Kansas and Okla. under 28 deg.	bbl.	.90 – .....
California, 35 deg. and up	bbl.	1.40 – .....

Gasoline, Etc.

Motor gasoline steel bbls.	gal.	$0.20 – .....
Naphtha, V. M. & P. deod, steel bbls	gal	.19 – ....
Kerosene, ref. tank wagon	gal.	.14 – .14½
Bulk, W.W. delivered, N.Y.	gal.	.08½ – .....
Lubricating oils:		
Cylinder, Penn., filtered	gal.	.31 – .37
Bloomless, 30@31 grav.	gal.	.22 – .23
Paraffin, pale 885 vis	gal.	.17½ – 18
Spindle, 200, pale	gal.	.22 – .....
Petrolatum, amber, bbls.	lb.	.04½ – .04½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	42–45
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	35–38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	38–40
Silicon carbide refract. brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 – .....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30 –	.....
4-6% C	lb.	.11½–	.....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	107.50 –	.....
Spiegeleisen, 19-21% Mn	gr. ton	36.00 –	38.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.25
Ferrosilicon, 10-12%	gr. ton	41.50 –	46.50
50%	gr. ton	75.00 –	.....
Ferrotungsten, 70-80%, per lb. of W	lb.	.90 –	.93
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 –	.....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 –	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 –	$8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 –	.....
C.i.f. Atlantic seaboard	ton	19 00 –	22.00
Coke, fdry., f.o.b. ovens	ton	4.50 –	5.00
Coke, furnace, f.o.b. ovens	ton	3.25 –	3.40
Fluorspar, gravel, f.o.b. mines, Illinois	ton	23.50 –	.....
Ilmenite, 52% TiO_2 Va.	lb.	.01½–	.....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.42 –	.46
Manganese ore, chemica (MnO_2)	ton	75.00 –	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80 –	.....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 –	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½–	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12 –	.....
Rutile, 94@96% TiO_2	lb.	.12 –	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25 –	.....
Tungsten, wolframite, 60% WO_3	unit	9.00 –	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 –	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 –	2.50
Vanadium pent oxide, 99%	lb.	2.00 –	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 –	1.25
Zircon, 99%	lb.	.06 –	.07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12¾–	$0.12¾
Aluminum, 98 to 99%	lb.	.27 –	.28
Antimony, wholesale, Chinese and Japanese	lb.	.08¾–	.08¾
Nickel, 99%	lb.	.27 –	.30
Monel metal, shot and blocks	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.42¾	
Lead, New York, spot		.07	
Lead, E. St. Louis, spot	lb.	.0695	
Zinc, spot, New York	lb.	.0615	
Zinc, spot, E. St. Louis	lb.	.0580	
Silver (commercial)	oz.	.66¼	
Cadmium	lb.	.60	
Bismuth (500 lb. lots)	lb.	2.35–2.40	
Cobalt	lb.	2.50–3.00	
Magnesium, ingots, 99%	lb.	.90–.95	
Platinum, refined	oz.	116.00	
Iridium	oz.	260.00–270.00	
Palladium	oz.	78.00–83.00	
Mercury	75 lb.	74.00–75.00	
Tungsten powder	lb.	.95–1.00	

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.25
Copper bottoms	29.25
Copper rods	19.75
High brass wire	17.75
High brass rods	15.00
Low brass wire	19.50
Low brass rods	20.50
Brazed bronze tubing	24.34
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound

Copper, heavy and crucible	10.50 @	10.75
Copper, heavy and wire	10.00 @	10.12½
Copper, light and bottoms	8.50 @	8.62½
Lead, heavy	5.67½@	5.87½
Lead, tea	3.75 @	4.00
Brass, heavy	6.00 @	6.25
Brass, light	4.75 @	4.87½
No. 1 yellow brass turnings	6.50 @	6.75
Zinc scrap	3.50 @	3.75

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.49	$3.49
Soft steel bars	3.49	3.49
Soft steel bar shapes	3.59	3.59
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.59	3.59

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—Under the direction of the local Chamber of Commerce, a project has matured for the erection of a new chemical manufacturing plant on site selected near the Sloss-Vanderbilt iron furnace. The name of the company is temporarily withheld and will be announced at an early date. The plant will consist of a number of a 1-story buildings, with power house, and is estimated to cost in excess of $300,000, including machinery.

Arizona

KINGMAN — The Silver Creek Bonanza mine, operated by J. J. McCarthy and associates, has preliminary plans under advisement for the installation of additional equipment at its local gold mine, primarily for deeper shaft work.

DOUGLAS—The Calumet & Arizona Mining Co. has plans under way for enlargements in its local smelting plant, including improvements in the present structure, to accommodate increased output at the mines of the New Cornelia Copper Co., Ajo, Ariz., an affiliated organization. A. G. McGregor, Warren, Ariz., is engineer in charge of plan preparation; General John G. Greenway is general manager.

California

GLENDALE—The Western American Concrete Co., 1147 Glendale Blvd., Los Angeles, is said to have purchased a tract of property on the San Fernando Rd., near Riverside Drive, Glendale, as a site for a new plant for the manufacture of concrete blocks and shapes. The machinery installation is estimated to cost $25,000. It is expected to commence work at an early date.

LOS ANGELES—M. W. Best has commenced operations at a new plant at 2043 Sacramento St. for the manufacture of asbestos shingles and kindred products, and purposes to develop a maximum output at an early date. George Keevil will be manager.

AVON—The Associated Oil Co., San Francisco, has awarded a general contract to Villadsen Brothers, Inc., Monadnock Bldg., San Francisco, for the construction of an addition to its local sulphur dioxide plant, comprising three 1-story buildings, estimated to cost $75,000. Work will be placed under way at once.

SAN JOSE—The Kartschoke Clay Products Co. has commenced the erection of a new plant at 3rd and Keyes Sts., to be equipped for the production of a line of vitrified clay products, including sewer pipe, tile, etc. A department will be operated, also, for the manufacture of firebrick and refractories. Clay properties have been secured for raw material supply. G. Kartschoke is president.

Florida

VERO—The Non-Acid Fertilizer Co. has perfected plans for the erection of a new local plant for the manufacture of a line of commercial fertilizer products, comprising a 2-story structure, 50x125 ft., on which work will be commenced at once. It will cost about $25,000, with equipment.

OCALA—The Cummer Lumber Co., Jacksonville, Fla., operating a local lime plant, has arranged for the immediate construction of a new unit for considerable increase in capacity, and plans to begin the installation of equipment at an early date. C. H. Lloyd is in charge of erection.

FORT MYERS—The Common Council will proceed at once with the erection of a new municipal gas plant, estimated to cost $120,000, including equipment. The installation will include gas-generating apparatus, scrubbers, compressors and auxiliary apparatus, with storage facilities.

Georgia

MACON—The General Reduction Co., Dry Branch, Ga., has plans nearing completion for its new local plant, on site acquired a number of months ago, and purposes to break ground at an early date. The structure will be used for the production of bleached clays, fullers earth, etc., and is estimated to cost in excess of $75,000, with machinery. It is planned to have the plant ready for service late in the fall.

Illinois

GRANITE CITY—The National Lead Co., International Life Bldg., St. Louis, Mo., has awarded a general contract to the Fruin & Colnon Construction Co., Merchants Laclede Bldg., St. Louis, for the erection of a 3-story building at its local plant, 80x185 ft., estimated to cost $150,000.

GRANITE CITY—The St. Louis Coke & Iron Co., St. Louis, Mo., has completed financial arrangements for the erection of its proposed local blast furnace, and has authorized immediate completion of plans for the project, estimated to involve $2,500,000. The company is now operating a blast furnace here, with byproduct coke ovens, with rated capacity of 600 tons per day, and the new unit will double this output. The work includes the construction of an electric power plant, designed to sell power to utilities operating in this district. W. C. Maguire is president.

Louisiana

NEW ORLEANS — The Board of Public Works, City Hall, will proceed with the erection of a 3-story chemical plant for the municipal waterworks, to be 48x160 ft., with storage department for 24 carloads of chemicals at one time. Extensions will also be made in the filtration plant, to advance the present capacity of 40,000,000 gal. by about 75 per cent. The work will be carried out in connection with an appropriation of $500,000, voted for plant expansion during the present year.

Maryland

BALTIMORE—C. M. Athey, 500-2 So. Hanover St., manufacturer of paints, varnish, etc., has preliminary plans under consideration for the rebuilding of the portion of his 4-story plant at location noted, destroyed by fire, June 6. Practically the entire factory was demolished. An official estimate of loss has not been announced.

BALTIMORE—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., manufacturer of enameled iron products, has filed plans for a group of buildings at its new local plant on 5th Ave., now in course of erection, consisting of a 1-story building to cost $200,000; six 1-story brick buildings to cost $260,000; a 1-, 2- and 3-story building, 100x252 ft., to cost $223,000; 2-story structure, 105x130 ft., costing $75,000; and 1-story, 98x590 ft., to cost $280,000.

Massachusetts

CANTON—The Norfolk Japaneries, Inc., Canton, manufacturer of japanned metal products, will proceed with the erection of four new buildings for its proposed local plant, comprising a main 1-story structure, 60x150 ft., and smaller structures. The works will be located on Neponset St., and are estimated to cost $75,000. A general contract has been awarded to the Reynolds Construction Co., Washington St., Canton. John O. De Wolfe, 45 Bromfield St., Boston, is engineer.

WORCESTER—The White & Bagley Co., Foster St., manufacturer of oils, soaps, etc., will soon begin the erection of a new 4-story building at its plant, estimated to cost in excess of $50,000.

Michigan

DETROIT—The Standard Oil Co., 1101 4th St., has awarded a general contract to Bryant & Detwiler, Dime Bank Bldg., for the erection of a new 1- and 2-story oil storage and distributing plant on Scotten St., to be 102x235 ft., estimated to cost $100,000, with equipment. Work will be placed in progress at once. E. P. Galbreath is local manager.

ADRIAN—The Acme Concrete Products & Gravel Co., of which A. C. Deer, vice-president of the Peninsular Portland Cement Co., Cement City, Mich., is president, has work in progress on a new local plant for the manufacture of concrete cast and pressed products, including tile, blocks, brick, etc. It is expected to have the plant ready for service at an early date.

Minnesota

ST. PAUL—The Healy-Ruff Co., Plymouth Bldg., manufacturer of radiator apparatus, etc., has tentative plans under advisement for the erection of a 1-story foundry at Water and Walter Sts., estimated to cost $27,000. It will be used primarily for the production of iron castings.

KEEWATIN—Pickands, Mather & Co., operating iron ore properties, with headquarters in the Sellwood Bldg., Duluth, have awarded a general contract to R. J. McLeod & Co., Builders Exchange, Duluth, for the construction of a 1-story building at the local mechanical department.

New Jersey

WARNERS—The American Cyanamid Co., 511 5th Ave., New York, has asked bids for the erection of a 3-story laboratory building on local site, 50x100 ft., estimated to cost $150,000, including equipment. W. I. Denning, 808 17th St., N. W., Washington, D. C., is architect.

HOBOKEN—The Lowenthal Rubber Co., Akron, O., has leased the 2-story factory occupying the block front on Provost St., between 13th and 14th Sts., Hoboken, and will occupy for an eastern branch plant. Immediate possession will be taken and improvements made to accommodate the new industry.

CAMDEN—Fire, May 31, destroyed a portion of the plant of the Frank C. Hitchner Wall Paper Co., 5th and Mickle Sts., with loss estimated at $17,000. It is planned to rebuild.

NEWARK — The Pittsburgh Plate Glass Co., Chester Ave., has acquired property adjoining its local plant along the Passaic River, comprising 4½ acres of land, for proposed expansion. It is said that actual preparation of plans will be deferred for the time being. Headquarters of the company are in the Frick Bldg., Pittsburgh, Pa.

JERSEY CITY — The Amalgamated Paint Co., 371 Wayne St., has filed plans for the erection of a 1-story addition to its plant, on which work will proceed at once.

New York

LONG ISLAND CITY—The Motorkool Oil Co. has leased a new factory to be erected at Harris Ave. and Hamilton St., and will equip the structure for the manufacture of lubricating and other oils for automobile service.

BUFFALO — The Buffalo Sintering Co., South Buffalo St., has awarded a general contract to the John W. Cowper Co., Fidelity Bldg., for the erection of a new plant for the manufacture of metal products, estimated to cost $125,000, with equipment.

Ohio

CLEVELAND—The White Motor Co., East 79th St., has construction under way on a new engineering laboratory, 2-story and basement, designed for two additional floors later, totaling about 55,000 sq.ft. Present physical, chemical and metallurgical laboratories and testing works will be removed to the new building and considerable additional equipment installed for increased operations; a complete heat-treating department will be installed. The structure will cost about $260,000, with equipment. Walter C. White is president.

Oregon

PORTLAND — The Electric Steel Foundry Co., York and 24th Sts., has filed plans for the erection of a 1-story foundry for steel-casting production, for which J. F. Hoss, Portland, is architect.

Pennsylvania

PHILADELPHIA—The Penn-Seaboard Steel Corp., Franklin Bank Bldg., with plants at Chester, Pa., and New Castle, Del., is perfecting plans for enlargements in its finishing mill to provide for the installation of additional equipment for the production of strip steel. The company will dispose of its subsidiary, known as the Penn Steel Castings Co.

PHILADELPHIA — The Endura Mfg. Co., Eastwick and 63rd Sts., manufacturer of oilproof and other processed papers, has leased space in the Milne Bldg., 11th and Washington Sts., totaling 18,000 sq.ft. of space, for extensions. Possession will be taken at once.

Tennessee

MEMPHIS—The Webster-Warnock Chemical Co., 807 Union Ave., has plans under way for a large addition, for which details are being perfected. Silas Riggs is president.

Texas

PORT ARTHUR — The Gulf Refining Co., Port Arthur, with headquarters in the Frick Annex, Pittsburgh, Pa., is reported to have preliminary plans under way for extensions and improvements in its local refining plant and oil distributing works, estimated to cost in excess of $1,000,000, with equipment. John W. Tryon is superintendent at the local refinery.

GREENVILLE—The National Refining Co., Breckenridge, Tex., has taken over the local oil refinery of the North Texas Refining Co., and plans to operate the plant at an early date. Extensions will be made, including the installation of additional equipment.

Wisconsin

MADISON — The National Chemical Research Council, care of J. H. Mathews, Chemistry Bldg., University of Wisconsin, has tentative plans under consideration for the erection of a chemical laboratory and research station, estimated to cost close to $500,000, with equipment. It is expected to select an architect in the near future.

New Companies

CHICAGO LUBRICATING OILS CO., Room 1501, 127 North Dearborn St., Chicago, Ill.; lubricating and other refined oils; $150,000. Incorporators: Philip H. Bopp, Albert N. Lewis and August H. Hartman.

BOULLEE-FRASER TANNING CO., 254 Woolsey St., Irvington, Newark, N. J.; operate a leather tannery; $300,000. Incorporators: Bradford C. Seaman and Frances W. Emerson.

STANDARD CARBONIC GAS & PRODUCTS, INC., Boston, Mass.; carbonic gas, commercial oxygen, etc.; $10,000. Joseph Ziskend, 34 Stanford St., is president and treasurer.

K. C. B. CHEMICAL CORP., Syracuse, N. Y.; chemicals and chemical byproducts; 60 shares stock, no par value. Incorporators: J. L. Schroeder, J. F. Moran and W. H. Bain. Representative: Hancock, Dorr, Spriggs & Shove, Syracuse, attorneys.

BETSON PLASTIC FIRE BRICK CO., St. Louis, Mo.; firebrick and other refractory products; capital not stated. Incorporators: William F. Shroeder and Joseph M. Curry, 2345 St. Louis Ave., St. Louis.

AMERICAN ACID WORKS, INC., Dallas, Tex.; acids and chemical specialties; $10,000. Incorporators: F. E. Ormsby, A. R. Thomasson and J. M. Still, all of Dallas.

ILLINOIS CHEMICAL & ALIZARIN CO., 7015 Jeffrey Ave., Chicago, Ill.; chemicals and affiliated products; nominal capital $5,000. Incorporators: Walter T. Winkler, R. M. Elder and F. V. Widger.

FIELD SOAP CO., Edina, Mo.; soaps, washing fluids, etc.; $200,000. Incorporators: F. W. Field and D. R. Nelson, both of Edina.

NEWTON PRESSED STEEL & MFG. CO., Newton, Mass.; steel products; $10,000. Amato Pescosolido, 36 Adams St., Newton, Mass., is treasurer and representative.

MINWOOL CO., 306 Association of Commerce Bldg., Grand Rapids, Mich.; insulating products; $10,000. Incorporators: Thomas D. Stafford, John N. Hardy and A. D. Crimmins, all of Grand Rapids.

VENECIN WORKS, INC., New York, N. Y.; chemicals and chemical bproducts; $10,000. Incorporators: P. Quittman, C. Nessler and W. Zoller. Representative: H. G. Wenzel, Jr., 165 Broadway, New York.

DAVEY OAKUM CO., 75 Montgomery St., Jersey City, N. J.; oakum and kindred products; 1,000 shares of stock, no par value. Incorporators: Patrick A. Dwyer, Carl S. Kuebler and Henry A. Oetjen.

COASTAL OIL & SULPHUR CO., Wilmington, Del., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington; refined oils, sulphur and other kindred products; $3,000,000.

VIGORLAC MFG. CO., INC., Gary, Ind., chemicals and affiliated products; $10,000. Incorporators: Harry G. Hanley, and Peter G. Sampanis, both of Gary.

RAPIDOL CO., Newark, N. J.; dyes, chemicals, etc.; $125,000. Incorporators: Walter A. Pledger and Frederick J. Matheson, 518 Broad St., Newark. The last noted is representative.

H. VAN DRIESSCHE CO., Gloversville, N. Y.; leather products; $50,000. Incorporators: H. Van Driessche, A. A. Farthing and E. W. Mills, all of Gloversville.

METALLIC FIBRE SPECIALTY CO., Boston, Mass.; organized; fiber products. Alonzo W. Hurlburt, Room 205, 161 Massachusetts Ave., heads the company.

PACIFIC COAST GLASS CO., Wilmington, Del., care of the Corporation Trust Co. of America, du Pont Bldg., Wilmington, representative; to operate a glass plant in the vicinity of Los Angeles, Calif.; $2,500,000.

MANHATTAN PASTE & GLUE CO., New York, N. Y.; glue and other adhesive products; $60,000. Incorporators: S. Stein, M. Sisenwein and M. A. Doody. Representative: M. E. Sanders, 42 Broadway, New York.

VALENTINE CHEMICAL CO., Boston, Mass.; organized; chemicals and chemical byproducts. William V. Flynn, 14 Alberta St., West Roxbury, Mass., heads the company.

AUTOLINE OIL CO., Dock and Caroline Sts., Baltimore, Md.; refined petroleum products; $1,024,500. Incorporators: Roger G. Williams, John Lewin and Albert E. Donaldson.

KARMA LABORATORIES, INC., New York, N. Y.; chemicals and chemical compounds $10,000. Incorporators: A. V. Skinner, M. F. Hessian and T. J. McElroy, Jr. Representative: N. P. Cullen, 165 Broadway, New York.

JAKE MFG. CO., Wilmington, Del., care of the Colonial Charter Co., Ford Bldg., Wilmington, representative; battery cleaning compounds and other kindred chemical specialties; $100,000.

ALABAMA OIL CO., Hollywood, Ala.; refined petroleum products; capital not stated. Incorporators: R. L. Crawford and J. D. Starkey, both of Hollywood.

EMPIRE CHEMICAL CO., Chelsea, Mass.; organized; chemicals and chemical compounds. John J. Cowan and Frank A. MacDonald, 267 2nd St., Chelsea, head the company.

LIBERTY PREPARED RED LEAD PAINT CO., Wilmington, Del., care of the Corporation Service Co., Equitable Bldg., Wilmington, representative; paints, varnishes, etc.; $200,000.

Industrial Notes

THE DIAMOND POWER SPECIALTY CORPORATION, of Detroit, Mich., manufacturer of Diamond soot blowers for water tube and horizontal return tubular boilers, has appointed W. L. Sullivan, 505 Central National Bank Bldg., Tulsa, Okla., as its representative for the state of Oklahoma. Mr. Sullivan has been in Tulsa for several years specializing in the sale of power plant equipment and machinery.

THE WORTHINGTON PUMP & MACHINERY CORPORATION, 115 Broadway, New York, announces that in order to concentrate its manufacturing facilities it has closed its power and mining works at Cudahy, Wis. All lines of product will be transferred to its other works, excepting the mining, crushing, cement and creosoting machinery, which has been taken over by the Allis-Chalmers Manufacturing Co., of Milwaukee, Wis. The transfer includes all of the records, drawings, patterns, patents, jigs, fixtures and manufactured stock pertaining to these lines.

THE MASON TIRE & RUBBER CO., Kent and Bedford, O., has recently elected W. A. Cluff, heretofore secretary, as president of the company to succeed O. M. Mason, resigned. Mr. Cluff will also act as treasurer of the company, succeeding, in such capacity, D. M. Mason, also resigned. T. G. Graham, factory manager for the past 3 years, has been elected secretary to fill the vacancy left by Mr. Cluff.

THE PARADON ENGINEERING CO., of Long Island City, N. Y., has been organized to manufacture chlorine control apparatus for all purposes, including water and sewage purification, bleaching and deodorization. The organizers are Richard V. Donnelly, formerly manager of sanitary sales for the Wallace & Tiernan Co., Howard J. Pardee, formerly in charge of production for the same company, and Sol Pincus, formerly with the United States Public Health Service.

THE ARMSTRONG CORK & INSULATION CO., Pittsburgh, Pa., announces the removal of its Denver, Colo., office to 720 Symes Bldg., and the Kansas City, Mo., office to 410 West Sixth St.

THE CANADIAN STEEL FOUNDRIES, LTD., Montreal, Que., announces that R. Armstrong has left its employ to take up new duties with the Canadian Brake Shoe & Foundry Co., Ltd., Sherbrooke, Que., as superintendent.

THE WIRELESS RESISTOR CO. OF AMERICA, Milwaukee, Wis., has changed its name to the American Resistor Co. The personnel of the organization will remain the same.